ADDENDUM TO
VOLUME IIA
REMEDIAL INVESTIGATION (RI)
WORK PLAN
NJDEP SITE IDENTIFICATION NO. 116
(STANDARD CHLORINE)

VOLUME I – REPORT AND
APPENDICES A THROUGH C

CHROMITE ORE PROCESSING RESIDUE SITES

NEW JERSEY

(Designated Under NJDEP April 17, 1990 ACO)

Prepared for:

Chemical Land Holdings, Inc.
Two Tower Center Boulevard
Floor 10
East Brunswick, New Jersey 08816

Prepared by:

Brown and Caldwell
440 Franklin Turnpike
Mahwah, New Jersey 07430

July 2001

19312.001

TABLE OF CONTENTS

Page No.

TABLE OF CONTENTS (CONTINUED)

LIST OF TABLES

LIST OF FIGURES

LIST OF FIGURES (CONTINUED)

LIST OF ACRONYMS

Acronym	Description
ACO	Administrative Consent Order
BOD_5	Biochemical oxygen demand
ChemRisk	ChemRisk, a service of McLaren/Hart
CLH	Chemical Land Holdings, Inc.
CLP	Contract Laboratory Program
COD	Chemical oxygen demand
COPR	Chromite ore processing residue
Cr	Chromium
Cr(III)	Trivalent chromium
Cr(VI)	Hexavalent chromium
Dioxin	2,3,7,8 - Tetrachlorodibenzo-p-dioxin (TCDD)
DMR	Discharge monitoring report
DNAPL	Dense non-aqueous phase liquid
DO	Dissolved oxygen
EDP	Equipment Decontamination Plan
EDR	Environmental Data Resources, Inc.
ERM	Environmental Resources Management, Inc.
French & Parrello	French & Parrello Associates, P.A.
FRI	Focused Remedial Investigation
FS	Feasibility Study
HASP	Health and Safety Plan
ICP	Inductively coupled plasma
IRM	Interim remedial measure
Key	Key Environmental, Inc.
Koppers	Koppers Company, Inc.
MCL	Maximum contaminant level
McLaren/Hart	McLaren/Hart Environmental Engineering Corporation
MSL	Mean sea level
NJPDES	New Jersey Pollutant Discharge Elimination System
NIOSH	National Institute of Occupational Safety & Health
N.J.A.C.	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection
NJGWQS	New Jersey Groundwater Quality Standards
OCC	Occidental Chemical Corp.
ORP	Oxidation reduction potential
OSHA	Occupational Safety and Health Administration
PCBs	Polychlorinated biphenyls
PEL	Permissible exposure limit
PRAC	Proposed Remedial Action Plan
QAPP	Quality Assurance Project Plan

LIST OF ACRONYMS (CONTINUED)

Acronym	Description
QA/QC	Quality assurance/quality control
RI	Remedial investigation
RIWP	Remedial Investigation Work Plan
ROST	Rapid Optical Screening Tool
SCCC	Standard Chlorine Chemical Company
SDG	Sample Delivery Group
SED	Sediment sample designation
SIPP	Site Investigation Project Plan
SNP	Standard Naphthalene Products, Inc.
SS	Surface soil sample designation
SSW	Surface water sample designation
Standard Chlorine	Standard Chlorine Chemical Company
SVOCs	Semivolatile organic compounds
TCDD	2,3,7,8 - Tetrachlorodibenzo-p-dioxin (Dioxin)
TDS	Total dissolved solids
UCL	Upper confidence limit
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOCs	Volatile organic compounds
W	Groundwater sample designation
Weston	Roy F. Weston, Inc.

1.0 BACKGROUND

1.1 INTRODUCTION

This Remedial Investigation Work Plan (RIWP) for Site 116 (Standard Chlorine) is presented as an addendum to Volume IIA of the RIWP for Chromite Ore Processing Residue (COPR) Sites approved by the New Jersey Department of Environmental Protection (NJDEP) in September 1992. It has been prepared in accordance with the April 17, 1990 Administrative Consent Order (ACO) executed by NJDEP, Occidental Chemical Corporation (OCC), and Chemical Land Holdings, Inc. (CLH), although its format has been expanded to provide an assessment of the large amount of previously collected data at this site.

1.2 OPERATIONAL AND OWNERSHIP HISTORY

1.2.1 Type of Operation Conducted

The Standard Chlorine Chemical Co., Inc. (SCCC) site occupies approximately 25 acres in the Hackensack Meadowlands of Kearny Township, New Jersey between Belleville Turnpike and the Hackensack River. Various forms of chemical manufacturing or processing have been carried on at this facility since the early part of the 20th century. SCCC's predecessors at Site 116 include the White Tar Company (White Tar), which purchased lots in the eastern part of the site in 1916. White Tar refined crude naphthalene (i.e., coal tar naphthalene) at the site from 1916 to 1942, when Koppers Company, Inc. (Koppers) acquired the facility and continued producing naphthalene products (processed approximately 11,000 tons/yr of crude naphthalene and naphthalene oil) and creosote disinfectants (Lowenstein, *et al.*, 1989a). In 1946, Koppers purchased additional adjacent property and subsequently operated the Tar Products Division – Meadows Plant, which included the storage and packaging of paradichlorobenzene moth preventatives and deodorizers in solid form.

The Thomas A. Edison Co., the Edison Storage Battery Co., and Emark Battery Corp. were manufacturers of batteries (Lowenstein, *et al.* 1993). Both acid and lead-lined acid equipment were used on site by these companies. Crown Rubber Products Inc. and Keaton Rubber Co. were manufacturers of insulating raw rubber parts, including electrical insulators and electrical rubber plugs. These activities are believed to have involved the use of rubber, various vulcanizing agents, antioxidants, and mineral fillers.

In 1962, part of the site was sold to SCCC and another part was sold to Standard Naphthalene Products, Inc. (SNP), a wholly-owned subsidiary of SCCC. Tanatex Chemical Corp, a part of Sybron Chemicals, Inc., which was acquired by A.G. Bayer in 2000, also operated at the site during the period 1959 to 1962 (Lowenstein, et al., 1993). Tanatex was a producer of dye carriers believed to have involved the use of various surfactants and solvents, including methylnaphthalenes, alkylated napthalenes, di- and trichlorobenzenes, biphenyl and other common dye carrier solvents until cessation of its operations in the early 1960s. In addition to the aforementioned entities, several other entities owned portions of the site prior to SCCC ownership, as listed below.

From 1963 to 1993, SCCC carried out one operation under its own name at this site, and another under the name of Cloroben Corporation (Cloroben), a subsidiary of SCCC. SNP processed liquid petroleum naphthalene at the site from 1963 until about 1982 to manufacture moth balls, crystals, and flakes. SNP did not engage in the refining of crude naphthalene oil at the site.

SCCC's business included the manufacture of moth crystals and flakes from dichlorobenzene isomers. SCCC separated dichlorobenzenes from 1963 until 1982. SCCC also separated and stored 1,2,4-trichlorobenzene from 1970 to 1980 (ACO, 1989).

For a few months after closing down its dichlorobenzene operation in 1981, SCCC converted liquid naphthalene into mothballs, flakes, and chips. This operation was discontinued in mid-1982. For some period extending to April 30, 1993, the Cloroben subsidiary of SCCC operated a batch formulation and blending operations at the site producing various solvent and inorganic chemicals for use in cleaning drains and sewers, as well as septic tanks.

Interpretation of aerial photographs indicates that at least two-thirds of the site had been filled by 1940. Most plant facilities and tank batteries (storage areas) were also in place by this time. Filling of the meadowlands took place throughout the 1940s and 1950s, although the most substantial portion of fill was introduced before late 1943. The two-segment pond (also referred to as the former lagoon and noted on the various figures in this RIWP as "Existing Pond") on the eastern portion of the site was constructed in the mid-1940s. It was expanded by 1959 and berms were added by 1961. Aerial photographs indicate that there have been discharges to the river from this site, some discharges to the meadowlands, and possible liquid discharges from tanks (JRB Associates, 1995).

1.2.2 Start and End Dates of Ownership/Operation

Owner	Start Date	End Date
Lot 48		
White Tar Company of NJ, Inc.	10/4/16	6/1/42
Koppers Company	6/1/42	11/9/44
Koppers Company, Inc.	11/9/44	7/9/62
Standard Naphthalene Products Co.	7/9/62	Present
Lot 49		
White Tar Company of NJ, Inc.	10/4/16	6/1/42
Koppers Company	6/1/42	11/9/44
Koppers Company, Inc.	11/9/44	7/9/62
Standard Naphthalene Products Co.	7/9/62	Present
Lot 49R		
State of New Jersey	N/A	Present

Lot 50		
Thomas A. Edison, Inc.	5/29/29	12/30/53
Crown Rubber Products, Inc.	xx/xx/47	9/1/59
Keaton Rubber Co.	9/1/59	10/17/62
Standard Chlorine Chemical Co., Inc.	10/17/62	Present
Lot 51		
Thomas A. Edison, Inc.	5/29/29	11/18/46
Koppers Company, Inc.	11/18/46	7/9/62
Standard Naphthalene Products Co.	7/9/62	Present
Lot 51R		
State of New Jersey	N/A	Present
Lot 52R		
Thomas A. Edison, Inc.	9/15/24	11/18/46
Lot 52		
Thomas A. Edison, Inc.	5/29/29	11/18/46
Lot 52, 52R		
Koppers Company, Inc.	11/18/46	7/9/62
Standard Naphthalene Products Co.	7/9/62	Present
Lot 54		
Koppers Gas and Coke Company (Becomes Koppers Company, Inc.)	12/29/33	6/24/88
Hudson County Improvement Authority	6/24/88	Present

1.2.3 Current Address of Owner/Operator

Standard Chlorine Chemical Company, Inc.
1035 Belleville Turnpike
Kearny, NJ 07032

1.3 RAW MATERIALS AND PRODUCTS

The file search uncovered no evidence of the production of COPR or the production or use of chromium or any of its compounds on the site, except the deposition of COPR as fill material in the process of reclaiming the site from the indigenous meadow lands.

Based on excerpts from a 1954 operating procedures manual, the plant at that time was primarily engaged in the "manufacture of refined naphthalene and disinfectants" (Lowenstein, *et al.*, 1989a). Crude naphthalene was received from the adjacent Koppers Tar Products Division Seaboard Plant, but was also imported in burlap bags from Europe. Naphthalene oil was purchased from domestic sources in Ohio, Pennsylvania and New York, along with caustic soda and sulfuric acid, for use in producing the refined naphthalene. Refined naphthalene was shipped to customers in liquid bulk, chipped, crushed, balled, and sublimed flake forms. Tar acid oil, neutral oil, pine oil and rosins, and occasionally petroleum tar acids were used in the production of disinfectants (Lowenstein, *et al.*, 1989a). Other raw materials were kerosene, linseed oil, castor oil, caustic potash, ligro, and solvent oil. During the mid-1950s, the facility had 26 large storage tanks with a total capacity of about 434,000 gal, ranging in size from 10,000 gal to 58,000 gal (Figure 116-1.1). In the period December 1958 to September 1960, between 1 million pounds and 2.8 million pounds of crude naphthalene were washed each month (Lowenstein, *et al.*, 1989b).

The facility included a combination maintenance shop, storage, and service building; boiler house; still house; subliming building; disinfectant and crude pan building; laboratory; naphthalene washer building; white pan building that housed chippers, ball presses, and a foreman's office; three storage buildings, can-filling and packaging building; paint shed, several pump houses; and a small service building. Refined naphthalene was shipped either in tank cars or small containers (e.g., drums).

Under the ownership of SCCC, 97% paradichlorobenzene (mothballs) was produced by crystallization, centrifugation, remelting, cooling, recrystallization, crushing, and screening. Until 1981, the production of orthodichlorobenzene and 1,2,4-trichlorobenzene utilized a fractionating column that was reportedly used two or three days a month for the distillation of trichlorobenzene (SCCC, 1983). Cloroben produced chlorinated benzene formulations, caustic soda flake, inhibited sulfuric acid, and inhibited hydrochloric acid using pine oil, hexalene glycol, isobenzene, propylene glycol, and either hydrochloric or sulfuric acid. From 1963 to 1987, orthodichlorobenzene was blended with soap and surfactants to make an emulsifiable drain cleaner. Between 1976 and 1981, average production was about 2.5 million lbs of orthodichlorobenzene (1,2-dichlorobenzene). In the period 1975-1980, approximately 1.5 million lbs of trichlorobenzene was produced (Figure 116-1.1) with approx. 75% as 1,2,4-trichlorobenzene and 25% as 1,2,3-trichlorobenzene (SCCC, 1983).

From 1982 to 1990, methylbenzoate blends were produced for the same end use; similarly, from 1990 to March 1993, terpene solvent blends were used for the same end use. The chlorinated benzene formulations were made by blending (in a batch process) chlorinated benzene with tall oil, alkali, non-ionic surfactants, and other minor constituents. The manufacture of the inhibited sulfuric and hydrochloric acids was also a batch process, where acid and a small amount of organic inhibitor were mixed together. The flake caustic soda was reported to be only a packaging operation.

At SNP, a pure petroleum naphthalene was cooled indirectly on a drum, scraped off, pressed, and packaged. The product was sold as moth flakes, crystals, or balls, or as bathroom deodorizers in various shapes.

For a few months in 1981, SCCC converted liquid naphthalene into mothballs, flakes, and chips through heating and cooling of product that had been transported to Kearny in rail cars and tank trailers from the company's Delaware City, Delaware, plant (Lowenstein, *et al.*, 1989a). The naphthalene was stored at Kearny and passed through a chipping machine, where flakes were produced by a sublimation process and collected into 1,500 lb. bags. Flakes and chips were also compressed into balls, although this operation was discontinued in mid-1982.

1.4 DISPOSAL PRACTICES AND POLLUTION SOURCES

COPR is alleged to have been deposited on this site. Various entities have estimated that COPR has been deposited on 75% or more of the area occupied by the site to a depth ranging to more than 10 feet (above the underlying meadow mat).

Based on a NJDEP Selected Substances Report dated August 1980, SCCC disposed an estimated 12,000 lb/yr of waste from the processing of 1,2,4-trichlorobenzene into the lagoon system between 1975 and 1979 (ACO, 1989). SCCC also estimated that 1,500 lb/yr of 1,2,4-trichlorobenzene were released in air emissions and 5,000 lb/yr were released in the wastewater discharge (Weston, 1993).

During the period in which various chemicals were manufactured at the facility, including prior to SCCC acquiring the property in the early 1960s, a settling lagoon system, located in the eastern portion of the site between the former Erie-Lackawanna Railroad and the Hackensack River, received wastewaters generated from various processes at the facility. The process wastewaters were discharged into the lagoon and the lagoon effluent overflowed by gravity into the adjacent Hackensack River. Although the former lagoon system still exists, measures were reportedly taken a number of years ago to stabilize the embankment adjacent to the river and eliminate the discharge of waters from the lagoon into the river (Weston, 1993).

Based on site reconnaissance observations, other process wastewaters and/or stormwater are suspected to have been discharged into a drainage ditch that emanates near the central part of the site, flows southeasterly, and eventually runs essentially parallel to the southern property boundary of the site. The waters that enter this drainage ditch have in the past and continue presently to discharge by gravity to the Hackensack River through a tide gate. There is also a storm water collection system that conveys storm water toward the northern boundary of the site into a 42" diameter storm water sewer that essentially straddles the northern property line and discharges to the river through a tide gate at the northeastern corner of the site.

Sanitary wastes from the various buildings were routed to a number of on-site septic tanks in scattered locations at the site. In addition, Koppers reportedly discharged boiler blowdown to the septic system (Weston, 1993).

Based on numerous remedial investigation efforts at Site 116 and adjacent Site 113 (Diamond) by a number of environmental firms, it has been determined by several investigations that chlorinated hydrocarbons in the form of dichlorobenzenes and trichlorobenzenes, and aromatic hydrocarbons in the form of naphthalene, are present in the form of both "residual" and "pooled" dense non-aqueous phase liquid (DNAPL) throughout much of Site 116 (refer to Section 2.2.5 for further discussion of DNAPL presence). The thickest measurements of pooled DNAPL (up to 2.89 feet) were encountered beneath the former dicholorbenzene manufacturing area (near Building No. 2) and former lagoon system (Key Environmental, 1999). Additionally, it has been determined through groundwater sampling and analysis that this DNAPL extends beyond the northeastern property boundary onto Site 113 (Brown and Caldwell, 2001). Furthermore, sampling and analysis of sediment samples collected from the Hackensack River near the Site 116 shoreline have exhibited measurable concentrations of these same DNAPL constituents.

At the direction of NJDEP, SCCC performed an inventory of containerized waste materials at Site 116 during the latter half of 2000. The inventory revealed the presence of 398 drums of Dioxin contaminated asbestos containing materials, 149 mostly empty drums, and the 143 drums containing tank bottoms and investigated waste (Enviro-Sciences, 2000a). SCCC reportedly disposed of the mostly empty drums, but expressed concern about disposal of the remaining inventory due to regulatory restrictions that SCCC claimed would not allow it to legally dispose of the materials at regulated hazardous waste facilities in the US. In a parallel activity, NJDEP requested USEPA to perform a removal action at the site, but the Federal agency has thus far exhibited reluctance to provide such assistance. Unsuccessful in obtaining a definitive commitment from SCCC or its operatives to complete remedial investigative activities and evaluate remedy alternatives, on March 13, 2001, NJDEP directed OCC and CLH to begin remedial investigation and remediation as stipulated in the April 17, 1990 ACO executed by NJDEP and OCC for Cr sites in Hudson County.

1.5 SITE PLANS AND CONSTRUCTION DRAWINGS

No evidence of the production of COPR or of chromium compounds has been uncovered through file investigations for this site, including plans, construction drawings, sketches, and Site 116 diagrams. However, as the facility was engaged in the manufacture of the previously mentioned organic chemicals, plans, construction drawings, sketches, etc. have been sought for the purpose of identifying the areas of the site where such operations were conducted. The contents of such documents that have been located are consolidated on various figures showing the locations of these operations in relationship to other features of the site, as described below.

1.6 AERIAL PHOTOGRAPHS

Aerial photographs were used to document the historic activity at the site as described above. Copies of the photographs are included in Attachment I.

1.7 SITE PROCESS WATER BUDGET

A process water budget has not been located for this site, although it is known that there was an on-site water supply well and the facility had a permit for the discharge of process wastewater from its operations prior to the cessation of manufacturing operations in about 1993. During 1969, SCCC and Cloroben were reported to have used about 200,000 gallons of municipal water per month, while SNP used about 3,000,000 gallons per month.

1.8 ECRA/ISRA SUBMITTALS

Available records do not show an ECRA or ISRA submittal for this site.

1.9 PERMITS

Prior to the cessation of production operations in the 1990s, SCCC's had surface discharge (NJPDES Discharge to Surface Water Permit No. NJ00001856) permit for both process wastewaters and domestic wastewaters. The septic tank system received boiler blowdown and laboratory wash water. The process wastewater permit shows discharge limits for chromium of 1 mg/L, as well as limits for other typical surface discharges (e.g., BOD_5, COD, petroleum hydrocarbons, pH, total suspended solids, total coliform). A provision for chromium monitoring was added reportedly because of the presence of COPR fill on the property. A former permitted discharge of non-contact cooling water from the naphthalene operation was discontinued about 1982 (ACO, 1989).

SCCC held air pollution control permits/certificates #030263 and #030267 for two Cleaver Brooks boilers based on applications submitted in March 1997. It also had four permits (#065590, #065591, #065592, & #065593) for tanks vents #18, #19, #20, and #25 based on applications submitted in March 1977. All of the equipment associated with these permits had been removed from the premises by 1993 (Lowenstein, *et al.* 1993).

1.10 ENFORCEMENT ACTIONS

1.10.1 Agency

NJDEP

<u>Dates</u>

Numerous enforcement actions are summarized in the October 20, 1990, Administrative Consent Order (ACO) executed by OCC, CLH, and NJDEP. Subsequently, NJDEP has repeatedly instructed SCCC to implement various activities under the ACO to (a) conduct interim remedial measures, (b) perform a remedial investigation/feasibility study of remedial action alternatives, and (c) implement a remedial action plan approved by the Department to remedy all pollution at the Site.

Subsequent notices of violation were also issued by the NJDEP to SCCC, such as one dated June 22, 1993 for NJPDES permit exceedances. A file search of enforcement actions has been conducted by Environmental Data Resources, Inc. and is provided in Appendix E.

1.10.2 Section of Statute Rule or Permit Violated

The Spill Compensation and Control Act, N.J.S.A. 58:10-23.11 et seq. and regulations promulgated pursuant thereto, N.J.A.C. 7:1E-1.1 et seq., and the Water Pollution Control Act, N.J.S.A, 58:10A-1 et seq., specifically N.J.S.A. 58:10A-6, and regulations promulgated pursuant thereto, N.J.A.C. 7:14A-1 et seq. have been cited by NJDEP as the statutory and regulatory bases of violations issued to SCCC.

1.10.3 Type of Enforcement Action

In July 1985, the Governor of New Jersey issued an executor order that declared an emergency and started the investigation of a number of industrial facilities in the State that were suspected of having 2,3,7,8,-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD or Dioxin) contamination in site soils or wastes. The identification of these sites was based on the nature of chemicals reportedly used at the facilities and their potential to form Dioxin in the course of facility operations. Site 116 was one of the sites identified for investigation as further discussed in Section 2.1. Several phases of investigation for potential Dioxin contamination at Site 116 ensued over the next several years, indicating the presence of Dioxin in and around the former lagoon area.

In October 1989, an Administrative Consent Order (ACO) was executed between SCCC and the NJDEP establishing the rationale and framework of activities and procedures to be used by SCCC to conduct the necessary remedial investigations and perform the remedial action(s) at Site 116. Various remedial investigative activities have occurred in the ensuing twelve years with Department oversight (refer to Section 2.1). However, in correspondence issued in late 2000 and early 2001, the Department has indicated that SCCC has not completed remedial investigation activities, nor has it fully implemented the steps outlined in a May 19, 2000 directive requiring SCCC to inventory and remove hazardous wastes from the site.

1.10.4 Description of Violations

The NJDEP Bureau of Water Compliance & Enforcement issued a series of letters over time indicating that the SCCC facility had achieved a rating of "Unacceptable" due to Discharge Monitoring Report (DMR) exceedances and inadequate treatment by septic tanks at the site. In responses to various communications regarding wastewater discharges, SCCC advised NJDEP that it would close the office building and cease the discharge of domestic wastes to septic tanks as part of its site remediation plan (Enviro-Sciences, 1999). No evidence has been located to confirm that such activities have been implemented.

1.10.5 Resolution

SCCC has made limited progress towards compliance with the 1989 ACO, and has repeatedly received written communications from NJDEP in the recent past threatening to activate non-performance provisions of the ACO. The administrative record under this ACO is replete with demands from NJDEP to supplement the remedial investigation reports and remedial action plans that have been submitted to the agency. Over the past several years, SCCC has stated that it has limited financial resources, and thus, it has most recently been working with another entity, Enviro-Sciences, Inc., to address the Department's demands. A proposed remedial action plan was submitted to NJDEP in November 2000 (Enviro-Sciences, 2001b). However, as of July 2001, it has not been reviewed by the Department, primarily because a suitable mechanism with sufficient funding has not yet been provided by SCCC or others for the estimated cost to implement the plan. In May 2001, the Department informed SCCC that it was contacting USEPA for a possible removal action associated with stored containers of waste at Site 116; however, USEPA responded that it was not then prepared to conduct such a removal action (NJDEP, 2001).

1.11 HAZARDOUS MATERIALS CONTAINMENT STRUCTURES

No chromium or chromium compounds containment structures are known to exist or to have existed on this site. Available documentation does not indicate the former or current existence of containment structures for potentially hazardous materials, such as tank field berms or other secondary containment barriers.

1.12 HAZARDOUS SUBSTANCES AND WASTES

COPR is reported to have been deposited at this site. A number of other hazardous substances and wastes have been managed at the site, as indicated in the aforementioned discussion of historical operations and in the discussion of pollutant monitoring below.

1.13 DISCHARGE AND REMEDIAL ACTIONS

Deposition of COPR is reported to have occurred at this site in the 1950s or 1960s. As further discussed in Section 2.1, Interim Remedial Measures (IRMs) have been implemented at the site to address potential human health concerns associated with COPR soils, consisting of the application of various IRM coverings in designated areas. Maintenance and monitoring of these IRMs have been conducted routinely since they were installed in the early 1990s.

To address erosion problems along the Hackensack River shoreline, SCCC completed IRM activities to minimize the potential for an accidental release from the former lagoon, removed extraneous scrap wood and metal debris, and built up the berm to provide a minimum of 2 ft of freeboard, and stabilized approximately 50 ft of the berm with geotextile covered with stone rip rap (d_{50} = 6 inches) (Weston, 1993). Additional IRM activities were conducted by SCCC in 1990 associated with (a) removing and securing the contents of five 10,000-gal aboveground storage tanks, (b) grouping and labeling approx. 106 drums, and (c) repackaging of asbestos-containing materials into PVC drums (Weston, 1993).

During October 1985, the bottom of an above-ground storage tank ruptured while the tank was being filled, resulting in the discharge of approximately 4,000 gallons of 31% hydrochloric acid onto the ground. The acid flowed into a drainage ditch where it was contained within a diked area, neutralized with sodium hydroxide, and removed by SCCC using a vacuum system (ACO, 1989).

A suspected released of polychlorinated biphenyls (PCBs) from a former transformer onto the ground outside the western wall of Building 2 (formerly used for dichlorobenzene manufacturing and storage) was investigated by Key Environmental (1999).

1.14 POLLUTANT MONITORING

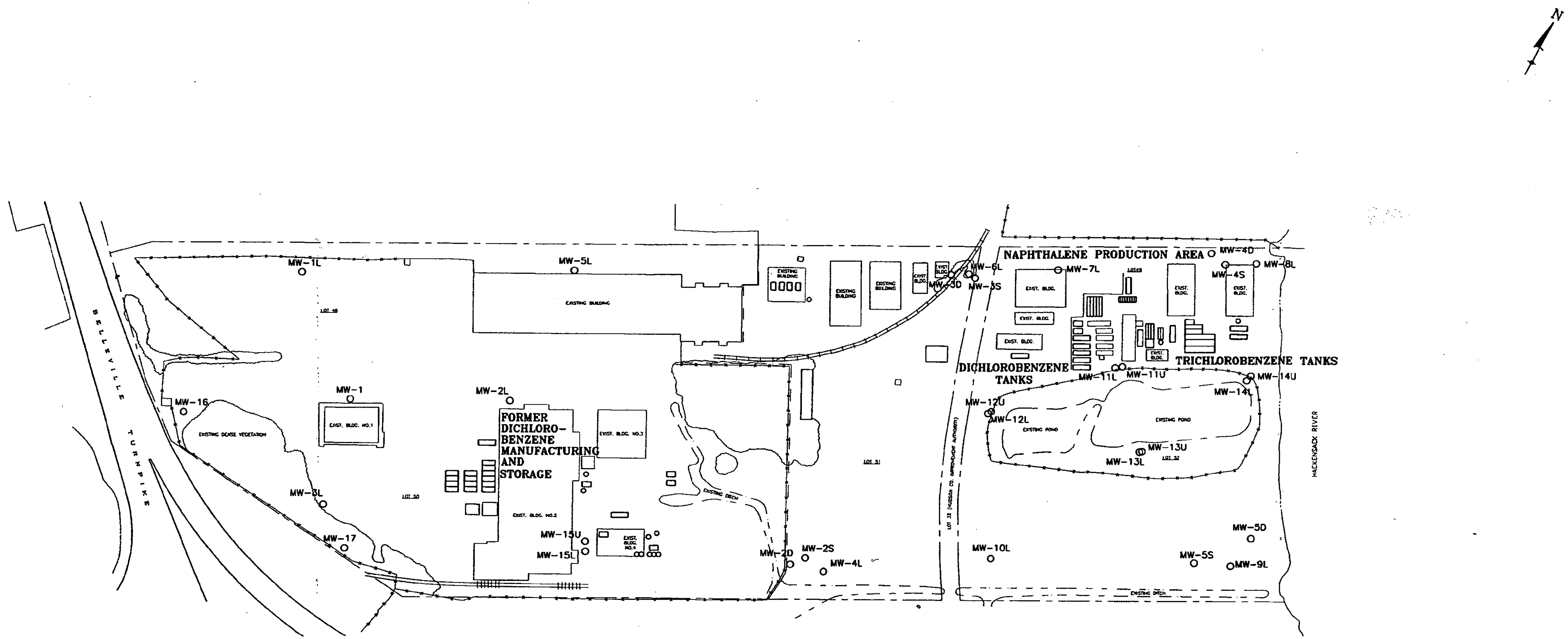
Due to the large amount of data previously collected at Site 116, a detailed chronology of the previous investigations is presented in Section 2.1, and a discussion of the results is provided in Section 2.2 of this RIWP.

1.15 SUMMARY, REVIEW, AND EVALUATION

This Site has been the recipient of COPR. Soil and groundwater sampling and testing results dating from 1984 indicate elevated levels of chromium in both media. Chromium was also detected in interior dust and dirt in 1989. In addition to the chromium contamination, organic contamination of soils, groundwater, surface water, and sediment is widespread and includes chlorobenzenes, naphthalene and Dioxin.

1.16 EVENTS POTENTIALLY IMPACTING HEALTH OR ENVIROMENT

In addition to the placement of COPR, this site has had a history of discharges and/or spills involving organic chemicals, particularly chlorobenzenes, naphthalene, and PCBs; acids; and fuel oil as described above and further discussed below.



LEGEND

MW-1 ○ PREVIOUSLY INSTALLED MONITORING WELLS

PROPERTY LINE

RIGHT OF WAY LINE

FENCE LINE

EXISTING STRUCTURE

FORMER ABOVE GROUND STORAGE TANK

NOTE: THIS FIGURE IS AN INTEGRAL PART OF RI WORK PLAN PREPARED IN RESPONSE TO THE APRIL 17,1990 ACO.

SOURCE: E. C. JORDAN, 1983 (FIGURE 1).

R1118-32 07/13/01 PLOT 1=80 (R1118-01.PCP)

80 0 80 160
scale feet

NO.	REVISIONS	REV'D BY	DATE	APPRO'D BY

BROWN AND CALDWELL
MAHWAH, NEW JERSEY

SCALE: AS SHOWN

DRAWN BY	DATE	CHECKED BY	APPROVED BY
JHM	06/01	JCS	WGS

STANDARD CHLORINE
SITE NO. 116
KEARNY, NEW JERSEY

LOCATION OF FORMER ABOVE GROUND STORAGE TANKS

SUBREGION I

FIGURE 116-1.1

2.0 SUMMARY OF EXISTING SITE CHARACTERIZATION

2.1 PREVIOUS INVESTIGATIONS

Numerous investigations have been conducted at the Standard Chlorine Site since the early 1980's. The scope of these efforts has varied widely, depending on the specific objective of the investigation, and the results have been presented in various documents ranging from letters to large RI reports and proposed remedial action plans. Table 116-01 is a chronological list of the more significant documents that have been identified and reviewed in the development of this RIWP. A document number has been assigned to each for ease of cross-referencing the data summary tables, figures, and text. Except where specifically noted, these data are assumed to be accurate for the intended purpose of this RIWP; that is, to identify specific data needs for the completion of a RI for chromium, including determination of media-specific endpoints and cleanup standards that will serve as input to a site-specific risk assessment and possible feasibility study (FS). It is also important to recognize, however, that a) no documentation has been identified to indicate that validation has been performed on the data presented in the various referenced documents to determine its usability, and b) a detailed assessment of the quality of these data is not within the scope of this RIWP.

A brief narrative of the chronology of the previous investigations conducted at Site 116 is provided below. An assessment of the data from these reports is provided separately, in Section 2.2.

<u>1983 Remedial Investigation (Weston)</u>

In 1983, representatives of Roy F. Weston, Inc. (Weston) conducted a hydrogeologic investigation of the Site (Document No. 2). The scope included the installation of 5 shallow monitoring wells and 5 deep monitoring wells. Wells screened in the upper water-bearing zone (shallow wells) were identified as MW-1S through MW-5S, and wells screened in the lower water-bearing zone (deep wells) were identified as MW-1D through MW-5D. The location of these wells is shown on Figure 116-2.1. The deep wells were constructed without the use of a double casing. Groundwater samples were analyzed for total Cr, Cr(VI), pH, conductivity, and selected volatile organic compounds/semi-volatile organic compounds (VOCs/SVOCs). None of the samples were field filtered, and the total Cr results were reported as "approximate". The Cr(VI) analysis was reportedly conducted using inductively coupled plasma (ICP) methods.

During the installation of these monitoring wells, 19 soil samples were collected and analyzed for metals and 5 samples were analyzed for VOCs. The soil samples were collected from above, within, and below the meadow mat. The reported sample depth intervals are shown on Tables 116-02 and 116-04. A summary of hydrogeologic investigative findings was subsequently issued by Weston (1984).

1985 Dioxin Investigation (E.C. Jordan & Weston)

In the early to mid-1980's, the NJDEP conducted a two-phased Dioxin sampling program at various sites in New Jersey. During Phase II of this State-wide program, samples were collected from Site 116 by representatives of E.C. Jordan under contract to NJDEP (Document No.3). These samples were collected on May 7, 1985 and included 13 soil samples and 3 sediment samples for analysis of Dioxin. Additional samples were collected in 1985 (supplemental Phase II) by Weston under contract to SCCC. The results of the samples collected in 1985 are summarized in Table 116-03 and depicted on Figure 116-2.7.

1987 Dioxin Investigation (Weston)

In February and March 1987, Weston conducted a "Stage I" Dioxin sampling event (Document No. 4) that included a total of 49 environmental samples as well as various performance samples. Based on the results, selected samples were retrieved from archive and re-analyzed for Dioxin. The results of the reanalyzed samples are referred to as Stages II and III (Document No. 5) and are also are summarized on Table 116-03. Since the samples collected in 1987 were primarily located in the vicinity of the former lagoons, a segment of the figure showing this area of the site was enlarged for readability (Figure 116-2.8) and the data are depicted separately from that collected in 1985.

1990 Interim Remedial Measures (Weston)

On October 20, 1989, an ACO was entered into between NJDEP and SCCC requiring implementation of IRMs, conduct of a RI/FS, and the implementation of remedial measures. In February and May, 1990 Weston prepared an IRM Work Plan (Document No. 6) and a Draft RI Work Plan (Document No. 7), respectively, on behalf of SCCC. The IRM work plan specifies the installation of fencing and gates to prevent access to the former lagoons, posting of warning signs, diking and grading to prevent stormwater overflow from the former lagoons to the river, and securing "spilled or damaged tanks/containers".

1990-1993 Remedial Investigation (Weston)

During December 1990 and January 1991, Weston implemented Phase I of the RI which included the installation of 5 upper zone monitoring wells (MW-11U through MW-15U), and 15 lower water-bearing zone wells (MW-1L through MW-15L). The lower water-bearing zone wells were reportedly double-cased through the meadow mat that underlies the site. One round of groundwater samples was collected from each of the 20 monitoring wells and analyzed for both organic and inorganic parameters. Waste characterization sampling, and surface water, sediment, and soil sampling were also conducted. The results were reported in a data report (Document No. 9, undated) and in Appendix B of the Supplemental RI Work Plan prepared by Weston dated August, 1992 (Document No. 11). The Supplemental RIWP for Phase II recommended the re-sampling of selected groundwater monitoring wells and other miscellaneous tasks. Data from both phases of this RI were presented in a Draft RI Report dated May 1993 (Document No. 12), and have been summarized on the various tables and figures in this RIWP.

1991 Interim Remedial Measures (French & Parrello)

On April 17, 1990, an ACO was executed between NJDEP and OCC and CLH in the matter identified as "The Town of Kearny and The Town of Secaucus Chromite Ore Processing Residue Sites and Occidental Chemical Corporation and Chemical Land Holdings, Inc., Respondents", which required the investigation of a number of COPR sites including Site 116. In response to the requirements of this ACO, various IRMs were planned and constructed at the Site by French and Parrello Associates on behalf of CLH (Document No. 8). The objective of the IRMs was the prevention of human exposure to COPR and its related compounds. The IRMs were constructed in 1991 in three phases; Phases I and II consisted of the placement of asphalt and stone covers over selected portions of the site, and Phase III consisted of the placement of a geomembrane liner within portions of the ditch area. A fence and windscreen was also installed along part of the perimeter of the lagoon area. The location of the various IRMs are shown on Figure 116-2.1.

Prior to the implementation of these IRMs, a number of surface soil samples, sweep samples and bulk samples were collected for the analysis of total Cr and Cr(VI). These data are summarized in Table 116-02 and depicted on Figures 116-2.4 and 116-2.5.

1990 Air Sampling (McLaren-Hart)

On October 26, 1990, air sampling was conducted by McLaren-Hart Environmental Engineering Corp. to characterize ambient indoor and outdoor chromium levels under baseline conditions. The results of this effort are contained in Document No. 10 and indicate that total Cr and respirable Cr(VI) concentrations were greater than 70,000 times less than the OSHA permissible exposure limit (PEL), and all indoor air samples were below the limit of detection. Based on these results, these data have not been summarized or further reproduced in this RIWP.

1996 Focused Remedial Investigation (ERM)

In April, 1996 a Focused Remedial Investigation (FRI) Work Plan for the former lagoon area was prepared (Document No. 13) and submitted to NJDEP by Environmental Resources Management, Inc. (ERM) on behalf of SCCC. The FRI Work Plan was approved by NJDEP on May 31, 1996 and implemented by ERM in August 1996. The field investigation consisted of the installation of 14 soil borings, collection of 8 discrete soil samples, collection of 4 surface water samples, and 7 sediment samples, and activities to locate and abandon the former SCCC production well drilled in 1917. The results were presented in the Focused RI Report by ERM dated January, 1997 (Document No. 15) and are summarized on the various tables and figures in this RIWP. A Proposed Remedial Action Plan (PRAP) was submitted concurrently with the FRI by ERM on behalf of SCCC (Document No. 16). This plan proposed that a perimeter vertical barrier wall and capping system be installed to isolate the fill/peat/sand units in the former lagoon area. Limited DNAPL recovery and groundwater monitoring of the lower water-bearing zone were also proposed.

1998-1999 Supplemental Remedial Investigation (Key)

In October 1998 and January 1999, a Supplemental RI was conducted by Key Environmental, Inc. (Key) on behalf of SCCC. This investigation consisted of the collection of surface soil samples and a concrete chip sample near the former PCB transformer pad (refer to Figure 116-2.1), sampling and abandonment of the former production well, installation of two monitoring wells in the lower water-bearing zone (MW-16L and MW-17L), analysis of selected soil samples from these borings, and the investigation of DNAPL using the Rapid Optical Screening Tool (ROST) technology. The results were presented in the Supplemental RI report (Document No. 16) dated April, 1999 and have been summarized on the various tables and figures in this RIWP.

2000 Hackensack River Sediment Sampling (Enviro-Sciences)

On January 17, 2000 a total of 27 sediment samples were collected from the Hackensack River adjacent to Site 116 by Enviro-Sciences, Inc. on behalf of SCCC. The samples were collected along three transects (A, B, and C) as shown on Figure 116-2.1. Each transect consisted of three horizontal locations; 1) at the high tide mark; 2) 15 feet out from location 1, and; 3) 35 feet out from location 1. At each sample location, three discrete depth intervals were sampled; one foot, five feet, and ten feet below the sediment surface.

The samples were collected using a manually-driven GeoProbe® sampler and analyzed for VOCs, SVOCs (including Dioxin), and metals (including Cr[VI]). The results were submitted to NJDEP in a letter dated October 23, 2000 (Document No. 20) and have been summarized in the various tables and figures of this RIWP.

2000 Surface Water Ditch Sampling (Brown and Caldwell)

On May 4 and May 25, 2000, surface water samples were collected from two locations in the drainage ditch located adjacent to the southern boundary of the Site by representatives of Brown and Caldwell on behalf of CLH. Location SW-1 is in the central portion of the site and location SW-2 is near the outfall of the drainage ditch that parallels the southern perimeter of the site and discharges into the Hackensack River. The samples collected on May 4 were analyzed for total Cr, Cr(VI), pH, ORP, TOC, TSS, and VOCs. The samples collected on May 25 were analyzed for VOCs and SVOCs. The results were submitted to NJDEP in a letter dated July 18, 2000 (Document No. 19) and have been summarized in the various tables and figures of this RIWP.

2.2 EVALUATON OF PREVIOUSLY COLLECTED DATA

In order to identify the remaining data needs for completion of a RI for chromium, data from the reports described above and listed on Table 116-01 have been compiled on summary Tables 116-02 through 116-09 and depicted on Figures 116-2.1 through 116-2.14. The objective of the data compilation and spatial distribution was to develop an understanding of the distribution of the various constituents in the soil, groundwater, surface water and sediment at the site. The presence and distribution of DNAPL was included as a separate medium in this effort. Based on the site's operational history and an initial review of the available data, constituents were arranged into the following groups for tabulation and spatial depiction.

- Total Cr
- Cr(VI)
- VOC's and SVOC's
- 2,3,7,8-TCDD (Dioxin)

Due to the large number of organic compounds that were analyzed, and for ease in reading the figures, only the most prevalent organic compounds were depicted. These are:

- Chlorobenzene
- 1,2-Dichlorobenzene
- 1,3-Dichlorobenzene
- 1,4-Dichlorobenzene
- Naphthalene

2.2.1 Soils

<u>Chromium</u>

The concentrations of total Cr and Cr(VI) in soil are presented in Table 116-02 and on Figures 116-2.4 and 116-2.5, respectively. The majority of the Cr(VI) data is from surface samples collected during the pre-IRM sampling event that indicate relatively low concentrations in the upper six-inches of soil. The maximum Cr(VI) concentration in these samples, for example, is 270 mg/kg at location 003. Cr(VI) concentrations in the samples collected from the 5 soil borings associated with the 1983 monitoring well installations were also found to be relatively low, and none of the samples collected below the meadow mat contained Cr(VI) above the detection limit. It is noteworthy that prior to the development of SW-846 Method 3060A, which was promulgated by USEPA in 1997, there was no accepted national extraction methodology for Cr(VI) in soils and other solid matrices (USEPA, 1997). Thus, Cr(VI) data in soil samples generated many years prior to the addition of Method 3060A to USEPA's Manual for Testing of Solid Wastes should be considered suspect quantitatively, with the exception of test results for Cr(VI) based on use of NJDEP-modified Method 3060, which is almost identical to Method 3060A.

Total Cr concentrations in soil were more indicative of the known presence of COPR above the meadow mat than the Cr(VI) data. Total Cr concentrations exceeding 10,000 mg/kg were reported in a number of soil samples in the site fill. However, none of the samples collected from below the meadow mat indicated elevated concentrations of total Cr. The highest total Cr concentration reported from below the meadow mat was 82 mg/kg in boring 2D. This lack of Cr in soils below the meadow mat is consistent with the known placement of COPR at the site.

Volatile and Semi-Volatile Organic Compounds

The concentrations of predominant VOCs/SVOCs in soil are presented in Table 116-04 and on Figure 116-2.6. Although soil samples for VOC/SVOC analysis were only collected from 5 borings, these data and the data shown on Figures 116-2.13 and 116-2.14 regarding the presence of DNAPL, indicate that the soil both above and below the meadow mat contains very high concentrations of VOCs/SVOCs. Specifically, the concentrations of chlorobenzene, dichlorobenzene, trichlorobenzene, and naphthalene were reported in the percent range in the former lagoon area. Again, these findings are consistent with the operational history of the site as described in Section 1.0.

Dioxin

Soil samples collected for Dioxin analysis in 1985 are shown on Figure 116-2.7 and are summarized in Table 116-03. The surface soil samples collected by E.C. Jordan in 1985 indicated that Dioxin was not present above the detection limit on the western portion of Site 116 (west of the railroad right-of-way). However, the reported concentrations of Dioxin in the former lagoon area were elevated in several samples. For example, sample EL-3 contained Dioxin at 62.1 ug/kg. Soil samples collected for Dioxin analysis in 1987 are shown on Figure 116-2.8 and are summarized in Table 116-03. These samples were collected within the lagoons and indicate that Dioxin is prevalent in these soils. This is consistent with the known operational history of the site as discussed in Section 1.0. The maximum reported Dioxin concentration in the surface soil within the lagoons is 268 ug/kg in sample J-3-SS. It should be noted that no analytical data has been located for the various Dioxin congeners, other than 2,3,7,8-TCDD, except for samples from four selected drums collected in late 2000 for characterization of the waste inventory at the site in response to a request from NJDEP.

2.2.2 Groundwater

Chromium

Cr concentrations in groundwater of the upper and lower water bearing zones are summarized in Table 116-05 and are depicted on Figures 116-2.9 and 116-2.10, respectively. The previous reports indicate that none of the samples were field filtered and thus the data represent "total" Cr concentrations. As shown on Figure 116-2.9, total Cr and Cr(VI) concentrations are elevated in the majority of the monitoring wells in the upper water-bearing zone. Since COPR is present in the upper zone throughout the site, these results are not unexpected. Concentrations of Cr(VI) in the upper zone ranged from less than 10 μg/L to 97,000 μg/L in MW-4S.

As shown on Figure 116-2.10, none of the groundwater samples collected from below the meadow mat were reported to contain Cr(VI) concentrations above the detection limit. Again, this is expected as the meadow mat has been shown to be an effective geochemical barrier to the potential migration of Cr(VI) to the lower zone. Total Cr concentrations in the deep monitoring wells varied widely from sample to sample, likely as a function of turbidity and/or color in the unfiltered samples that can induce false positive Cr(VI) results and the position of the screened interval relative to the meadow mat. Total Cr concentrations in the unfiltered groundwater ranged from 14 μg/L to 67,300 μg/L.

Three groundwater samples were collected in 1999 from the former SCCC production well (abandoned by a New Jersey-licensed driller in 1999) by Key (1999). It is noteworthy that the casing for this well was driven into bedrock at depth of about 73' bgs (Weston, 1993). The samples were collected from the upper bedrock zone (88 feet bgs), an intermediate zone (228 feet bgs), and at the bottom of the well (360 feet bgs). The results indicated total Cr concentrations ranging from 819 ug/L to 989 ug/L in unfiltered samples. Cr(VI) was not included in the analysis. These results are further discussed in Section 3.2.

Volatile and Semi-Volatile Organic Compounds

Predominant VOC/SVOC concentrations in groundwater of the upper and lower water bearing zones are summarized in Table 116-06 and selected constituents (chlorobenzene, dichlorobenzene, and naphthalene) are depicted on Figures 116-2.11 and 116-2.12, respectively. VOCs/SVOCs were detected in each of the monitoring wells in the upper water-bearing zone with the exception of MW-1S. As expected based on the site's operational history, the concentrations are elevated and are generally higher in the area of the former lagoons where process wastewaters were routed for settling of suspended solids prior to gravity discharge of the aqueous phase to the river.. The highest concentration of chlorobenzene in the upper water-bearing zone for example, was reported in the northeast corner of the site in monitoring well MW-4S at 93,000 μg/L.

The concentrations of VOCs/SVOCs in the lower water-bearing zone were generally greater and more widely distributed than in the upper water-bearing zone. This is likely a consequence of the dissolution of the residual and pooled DNAPL that is present in this zone. The distribution of DNAPL in the lower water-bearing zone is shown on Figure 116-2.14 and is further discussed in Sections 2.2.5 and 3.2.

The three groundwater samples from the former SCCC production well (discussed above) were also analyzed for VOCs. Chlorobenzene, dicholorbenzene, and naphthalene, each of which has a specific gravity greater than water, were not reported above the detection limit in any of the samples.

Dioxin

The analysis of Dioxin in groundwater has been limited to four monitoring wells in the upper zone and four wells in the lower zone. These data are presented in Table 116-07 and on Figures 116-2.11 and 116-2.12, for the upper and lower zones, respectively. None of the eight samples reported Dioxin at a concentration above the detection limit. This is not surprising since Dioxin has a very low solubility, and thus, is not particularly mobile in groundwater.

Other Parameters

It is noteworthy that the pH of groundwater at Site 116 varies from about 2.0 to greater than 11, with the upper water-bearing zone showing a trend toward alkaline and the lower water-bearing zone showing a trend toward acidic (Weston, 1984). Additionally, the conductivity ranges from approximately 1,000 to 5,000 umhos/cm indicating that both the upper and lower water-bearing zones contain elevated levels of dissolved solids.

2.2.3 Sediment

Chromium

The concentrations of total Cr and Cr(VI) in sediments are presented in Table 116-02 and on Figures 116-2.4 and 116-2.5, respectively. The only sediment samples analyzed for Cr(VI) at the site were the samples collected in January, 2000 from the Hackensack River by Enviro-Sciences (2000b). Cr(VI) was reported above the detection limit in 3 of the 27 samples, ranging in concentration from 3.81 mg/kg to 78.1 mg/kg. Each of these positive detections were in transect A, located adjacent to the northeast corner of the Site, and at depths ranging from 5 to 10 feet below the surface of the riverbed. Because sediment samples typically are derived from environmental settings that exhibit reducing properties and do not support the existence of Cr(VI), the validity of these positive Cr(VI) values remains to be determined. Additionally, sediment samples often require extra attention, compared to ground water samples, during analysis to avoid turbidity and/or color interference that can impart false positive results. These concerns will be addressed via the proposed sampling and analysis plan presented below.

Total Cr was analyzed in numerous sediment samples across the site, including the drainage ditches, lagoons, and the aforementioned Hackensack River transects. Concentrations were reported elevated at many of the on-site locations due to the presence of COPR in the fill. In the 27 samples collected from the Hackensack River in 2000, total Cr concentrations were generally in excess of 1,000 mg/kg in the one-foot depth interval and less than 50 mg/kg (equivalent to background soil levels) in the ten-foot depth interval (Envio-Sciences, 2000b). The five-foot depth interval contained intermediate total Cr concentrations.

Volatile and Semi-Volatile Organic Compounds

The concentrations of VOCs/SVOCs in sediments are presented in Table 116-04 and on Figure 116-2.6. As with the distribution of VOCs/SVOCs in soil, the selected

VOCs/SVOCs of interest are present in sediment samples collected throughout the site, including in the area west of the railroad right-of-way. The results from the 27 samples collected from the Hackensack River (January, 2000) indicate that samples A1 and A2 at the ten-foot depth interval contained the highest concentrations of VOCs/SVOCs. 1,3-Dichlorobenzene, for example, was reported at 29,700 ug/kg in sample location A1 at the ten-foot depth interval. Lower concentrations of VOCs/SVOCs were also detected in other depth intervals as shown on Figure 116-2.6.

Dioxin

Dioxin was only analyzed in the sediment samples collected from the Hackensack River in 2000. None of the 27 samples exhibited Dioxin above the detection limit.

2.2.4 Surface Water

Chromium

File review revealed three surface water samples collected in 1979 from the former lagoon and drainage ditch on SCCC property. The total Cr ranged from 0.139 to 0.241 mg/L, while Cr(VI) was reported to be either less than 0.05 mg/L or not detected (Weston, 1983). Only two other on-site surface water samples (116-SW-1 and 116-SW-2) have been identified that were analyzed for Cr(VI) during previous investigations. These were the samples collected in May 2000 from the drainage ditch as shown on Figure 116-2.9 and in Table 116-05 (Brown and Caldwell, 2000). The results included a Cr(VI) concentration of 50 μg/L in the interior (upstream) sample and 41 μg/L near the outfall to the river. These are both unfiltered sample results. Total Cr in these samples was reported at 422 μg/L for the interior sample and 85 μg/L for the sample taken near the outfall. Other on-site surface water samples reported elevated concentrations of total Cr at the majority of the sampled locations, likely due to their association with the COPR fill. Two surface water samples taken within the former lagoons exhibited total Cr concentrations ranging from 300 μg/L in the west lagoon to 20,300 μg/L in the east lagoon.

Volatile and Semi-Volatile Organic Compounds

VOC/SVOC concentrations in surface water are summarized in Table 116-06 and selected constituents (chlorobenzene, dichlorobenzene, and naphthalene) are depicted on Figure 116-2.11. As with the distribution of VOCs/SVOCs in soil and sediment, the selected VOCs/SVOCs of interest are present in the majority of the surface water samples collected throughout the site, including in the area west of the railroad right-of-way. In the Hackensack River, several sediment VOCs/SVOCs were reported above the detection limit, but at relatively low concentrations (less than 10 μg/L).

Dioxin

A review of the available data indicates that Dioxin analysis has not been reported for any of the surface water samples collected at the Site to date.

2.2.5 DNAPL

The inferred distribution of "residual" DNAPL in the upper and lower water-bearing zones is depicted on Figures 116-2.13 and 116-2.14, respectively. The inferred limits were developed by Brown and Caldwell based on a compilation of the previous data as discussed in Section 2.1. These data include the results of the ROST borings conducted in 1999, and the measurements of DNAPL thickness in monitoring wells as summarized in Table 116-08. It is noteworthy, but not unusual, that the inferred extent of residual DNAPL is generally greater in the lower zone than in the upper zone. This implies that although the meadow mat functions as an effective geochemical barrier for Cr(VI), it does not function as a physical barrier for the vertical movement of DNAPL at Site 116.

Pooled DNAPL has been detected in six of the over 20 monitoring wells at the Site as summarized on Table 116-08. Each of these wells is screened in the lower water-bearing zone with the reported thickness of the pooled DNAPL ranging from not present to 2.89 feet in well MW-8L. This well is located directly adjacent to monitoring well 113-W-106 on Site 113 (Diamond) in which DNAPL and elevated concentrations of these same compounds have been reported (Brown and Caldwell, 2001). The presence of significant naphthalene and chlorobenzenes concentrations in ground water at Site 113 was determined as early as 1982 (NJDEP, 1983). The collective ground water data for monitoring well 113-W-106 and the many Site 116 monitoring wells definitively link the prevalence of these DNAPL constituents to past operations at Site 116.

Samples of the pooled DNAPL were obtained from four wells by ERM in 1995 and analyzed for selected VOCs/SVOCs. These data are summarized on Table 116-09 and indicate that the DNAPL consists primarily of chlorobenzene, dichlorobenzene, trichlorobenzene, and naphthalene. These samples were not analyzed for chromium or Dioxin.

2.2.6 Pre-IRM Air Sampling

On October 26, 1990, air sampling was conducted by McLaren-Hart Environmental Engineering Corp. to characterize ambient indoor and outdoor chromium levels under baseline conditions. The results of this effort are contained in Document No. 10 and indicate that total Cr and respirable Cr(VI) concentrations were greater than 70,000 times less than the OSHA permissible exposure limit (PEL), and all indoor air samples were below the limit of detection.

TABLE 116-01

LIST OF SIGNIFICANT PROJECT DOCUMENTS
SITE 116 – STANDARD CHLORINE CHEMICAL COMPANY

Document Ref. No.	Date	Title	Prepared By	Prepared For
1	Oct. 1983	RI Report	Roy F. Weston, Inc. (Weston)	Standard Chlorine Chemical Company (SCCC)
2	Jan. 1984	Hydrogeologic Investigation	Weston	SCCC
3	Dec. 1985	Phase II Dioxin Site Investigation Final Report	EC Jordan	SCCC
4	Sept. 1987	Sampling and Analysis of Potentially Dioxin-Contaminated Materials in Waste Lagoons: Stage I	Weston	SCCC
5	May 1988	Sampling and Analysis of Potentially Dioxin-Contaminated Materials in Waste Lagoons: Stages II & III	Weston	SCCC
6	Feb. 1990	IRM Work Plan	Weston	SCCC
7	May 1990	Draft RI Work Plan	Weston	SCCC
8	Jan. 1991	Modified IRM Work Plan	French and Parrello	Maxus Energy
9	?	Analytical Results of Surface Sampling and Ground Water Sampling	Weston	SCCC
10	Jan. 1991	Airborne Cr Sampling	McLaren Hart Env. Eng. Corp.	Maxus Energy Corp. (Maxus)
11	Aug. 1992	Supplemental RI Work Plan	Weston	SCCC
12	May 1993	Draft RI Report	Weston	SCCC
13	April 1996	Focused RIWP (Lagoon Area)	Environmental Resources Management, Inc. (ERM)	SCCC
14	Jan. 1997	Focused RI Report (Lagoon Area)	ERM	SCCC
15	Jan 1997	Proposed RAP	ERM	SCCC
16	April 1999	Supplemental RI	Key Environmental	SCCC
17	Oct. 1999	RI Work Plan	Enviro-Sciences	SCCC
18	Nov. 2000	Remedial Action Work Plan	Enviro-Sciences	SCCC
19	July 2000	Ditch Sampling Results	Brown and Caldwell	Chemical Land Holdigs, Inc. (CLH)
20	Oct 2000	Hackensack River Sediment Sampling	Enviro-Sciences	SCCC

TABLE 116 - 02
SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION
PREVIOUS INVESTIGATIONS
TOTAL AND HEXAVALENT CHROMIUM
SITE 116 - STANDARD CHLORINE CHEMICAL COMPANY

Sample ID	Date Collected	Collected By	Document* Reference	Sample Type	Units	Depth (ft bgs)	Total Cr	Cr(VI)
1D-5-7	7/83	Weston	2	Split spoon	mg/kg	5-7	150	<0.1
1D-MM	7/83	Weston	2	Split spoon	mg/kg	NR	3	<0.1
1D-15-16	7/83	Weston	2	Split spoon	mg/kg	15-16	6	<0.1
2D-5-7	7/83	Weston	2	Split spoon	mg/kg	5-7	31,100	14.4
2D-MM	7/83	Weston	2	Split spoon	mg/kg	NR	16,500	0.7
2D-13	7/83	Weston	2	Split spoon	mg/kg	13	82	<0.1
2D-13-15	7/83	Weston	2	Split spoon	mg/kg	13-15	48	<0.1
3D-2-3	7/83	Weston	2	Split spoon	mg/kg	2-3	31,300	5.7
3D-5-7	7/83	Weston	2	Split spoon	mg/kg	5-7	745	<0.1
3D-MM	7/83	Weston	2	Split spoon	mg/kg	NR	9,900	<0.1
3D-12-13	7/83	Weston	2	Split spoon	mg/kg	12-13	10	<0.1
4D-MM	7/83	Weston	2	Split spoon	mg/kg	NR	770	<0.1
4D-15-17	7/83	Weston	2	Split spoon	mg/kg	15-17	49	<0.1
4D-15-17	7/83	Weston	2	Split spoon	mg/kg	15-17	36	<0.1
5D-5-7	7/83	Weston	2	Split spoon	mg/kg	5-7	18,000	38
5D-MM	7/83	Weston	2	Split spoon	mg/kg	NR	7,600	<0.1
5D-17-19	7/83	Weston	2	Split spoon	mg/kg	17-19	12	<0.1
Lagoon 1	7/83	Weston	2	Sediment	mg/kg	NR	7,700	<0.1
Lagoon 2	7/83	Weston	2	Sediment	mg/kg	NR	6,400	<0.1
WLS-1	1/91	Weston	9	Lagoon Sediment	mg/kg	NR	200	NR
WLS-2	1/91	Weston	9	Lagoon Sediment	mg/kg	NR	521	NR
ELS-1	1/91	Weston	9	Lagoon Sediment	mg/kg	NR	767	NR
ELS-2	1/91	Weston	9	Lagoon Sediment	mg/kg	NR	2,080	NR
Tank #1	1/91	Weston	9	Drum Solid	mg/kg	NR	3.6	NR
Tank #2	1/91	Weston	9	Drum Solid	mg/kg	NR	192	NR
Tank #3	1/91	Weston	9	Drum Solid	mg/kg	NR	324	NR
Tank #4	1/91	Weston	9	Drum Solid	mg/kg	NR	252	NR
Tank #5	1/91	Weston	9	Drum Solid	mg/kg	NR	20	NR
SSW/SED-1	1/91	Weston	9	Sediment	mg/kg	NR	12,700	NR
SSW/SED-2	1/91	Weston	9	Sediment	mg/kg	NR	5,560	NR
SSW/SED-3	1/91	Weston	9	Sediment	mg/kg	NR	16,400	NR
SSW/SED-4	1/91	Weston	9	Sediment	mg/kg	NR	930	NR

TABLE 116 - 02
SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION
PREVIOUS INVESTIGATIONS
TOTAL AND HEXAVALENT CHROMIUM
SITE 116 - STANDARD CHLORINE CHEMICAL COMPANY

Sample ID	Date Collected	Collected By	Document* Reference	Sample Type	Units	Depth (ft bgs)	Total Cr	Cr(VI)
SSW/SED-5	1/91	Weston	9	Sediment	mg/kg	NR	12,600	NR
SED-1	1/91	Weston	9	Sediment	mg/kg	NR	3,440	NR
SED-2	1/91	Weston	9	Sediment	mg/kg	NR	100	NR
TP #1	5/93	Weston	12	Test pit	mg/kg	4	31,900	NR
TP #2	5/93	Weston	12	Test pit	mg/kg	1.5	1,740	NR
TP #3	5/93	Weston	12	Test pit	mg/kg	2	26,300	NR
TP #4	5/93	Weston	12	Test pit	mg/kg	2	34,900	NR
TP #5	5/93	Weston	12	Test pit	mg/kg	6	33,100	NR
TP #6	5/93	Weston	12	Test pit	mg/kg	2.5	30,400	NR
TP #7	5/93	Weston	12	Test pit	mg/kg	2	32,100	NR
TP #8	5/93	Weston	12	Test pit	mg/kg	3	32,600	NR
001	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	722	<2.7
002	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	17.5	<3
003	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	1,990	270
004	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	21.4	<3
005	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	733	8.2
006	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	2,000	16
007	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	2,520	13
008	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	1,490	15
009	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	2,540	110
010	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	529	8.6
011	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	579	<30
012	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	129	<3.6
013	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	1,100	7.3
014	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	2,240	13
015	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	520	3.4
016	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	769	12
017	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	511	3.8
018	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	224	3
031	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	9,900	<0.14
032	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	5,330	0.65
033	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	9,900	244

TABLE 116 - 02
SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION
PREVIOUS INVESTIGATIONS
TOTAL AND HEXAVALENT CHROMIUM
SITE 116 - STANDARD CHLORINE CHEMICAL COMPANY

Sample ID	Date Collected	Collected By	Document* Reference	Sample Type	Units	Depth (ft bgs)	Total Cr	Cr(VI)
034	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	18,000	<0.11
035	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	11,000	0.39
036	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	6,460	<0.26
037	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	5,120	54
038	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	18,800	<0.23
039	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	11,500	195
040	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	7,050	<0.24
041	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	9,390	0.15
042	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	11,900	<0.12
043	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	8,570	<0.15
044	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	579	<0.26
045	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	95.7	<0.13
046	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	59.7	<0.14
047	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	142	<0.14
048	8/91	French & Parrello	8	Surface Soil	mg/kg	0-0.5	188	<0.28
001	8/91	French & Parrello	8	Sweep Sample	mg/kg	NA	623	<2.7
002	8/91	French & Parrello	8	Sweep Sample	mg/kg	NA	322	33
003	8/91	French & Parrello	8	Sweep Sample	mg/kg	NA	423	12
TPS-A1-1	1/00	ES	20	Sediment	mg/kg	1	3,207	ND
TPS-A1-5	1/00	ES	20	Sediment	mg/kg	5	9.5	ND
TPS-A1-10	1/00	ES	20	Sediment	mg/kg	10	24.7	ND
TPS-A2-1	1/00	ES	20	Sediment	mg/kg	1	3,197	ND
TPS-A2-5	1/00	ES	20	Sediment	mg/kg	5	930	73.1
TPS-A2-10	1/00	ES	20	Sediment	mg/kg	10	38.7	3.81
TPS-A3-1	1/00	ES	20	Sediment	mg/kg	1	1,280	ND
TPS-A3-5	1/00	ES	20	Sediment	mg/kg	5	257	4.29
TPS-A3-10	1/00	ES	20	Sediment	mg/kg	10	14.3	ND
TPS-B1-1	1/00	ES	20	Sediment	mg/kg	1	1,079	ND
TPS-B1-5	1/00	ES	20	Sediment	mg/kg	5	143	ND
TPS-B1-10	1/00	ES	20	Sediment	mg/kg	10	6.59	ND
TPS-B2-1	1/00	ES	20	Sediment	mg/kg	1	5,240	ND
TPS-B2-5	1/00	ES	20	Sediment	mg/kg	5	34.2	ND

TABLE 116 - 02
SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION
PREVIOUS INVESTIGATIONS
TOTAL AND HEXAVALENT CHROMIUM
SITE 116 - STANDARD CHLORINE CHEMICAL COMPANY

Sample ID	Date Collected	Collected By	Document* Reference	Sample Type	Units	Depth (ft bgs)	Total Cr	Cr(VI)
TPS-B2-10	1/00	ES	20	Sediment	mg/kg	10	12.8	ND
TPS-B3-1	1/00	ES	20	Sediment	mg/kg	1	376	ND
TPS-B3-5	1/00	ES	20	Sediment	mg/kg	5	27	ND
TPS-B3-10	1/00	ES	20	Sediment	mg/kg	10	43	ND
TPS-C1-1	1/00	ES	20	Sediment	mg/kg	1	11,700	22.1
TPS-C1-5	1/00	ES	20	Sediment	mg/kg	5	14,400	ND
TPS-C1-10	1/00	ES	20	Sediment	mg/kg	10	14.8	ND
TPS-C2-1	1/00	ES	20	Sediment	mg/kg	1	2,790	ND
TPS-C2-5	1/00	ES	20	Sediment	mg/kg	5	51.3	ND
TPS-C2-10	1/00	ES	20	Sediment	mg/kg	10	25.5	ND
TPS-C3-1	1/00	ES	20	Sediment	mg/kg	1	4,580	ND
TPS-C3-5	1/00	ES	20	Sediment	mg/kg	5	53	ND
TPS-C3-10	1/00	ES	20	Sediment	mg/kg	10	14.8	ND

Notes
*- Refer to List of Documents (Table 116-01)
TP - Test Pit Sample
SSW - Surface Water/Sediment Sample
SED - Sediment Sample
bgs - Below ground surface or sediment surface in river
Weston - Roy F. Weston, Inc.

NA - Not Applicable
NR - Not Requested or Reported
MM - Meadow Mat
ES - Enviro-Sciences, Inc.
ND - Not Detected
TPS - Transect Sediment Sample

TABLE 116 - 03
SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION
PREVIOUS INVESTIGATIONS
2,3,7,8-TCDD (DIOXIN)
SITE 116 - STANDARD CHLORINE CHEMICAL COMPANY

Sample ID	Dioxin Program	Date Collected	Collected By	Document* Reference	Sample Type	Depth (bgs)	units	2,3,7,8-TCDD (Dioxin)
1	Phase II	5/85	EC Jordan	3	Surface Soil	0-0.5	ug/Kg	<0.15
2	Phase II	5/85	EC Jordan	3	Surface Soil	0-0.5	ug/Kg	<0.6
3	Phase II	5/85	EC Jordan	3	Surface Soil	0-0.5	ug/Kg	<0.037
4	Phase II	5/85	EC Jordan	3	Surface Soil	0-0.5	ug/Kg	<0.62
6	Phase II	5/85	EC Jordan	3	Surface Soil	0-0.5	ug/Kg	<0.54
7	Phase II	5/85	EC Jordan	3	Surface Soil	0-0.5	ug/Kg	<0.67
8	Phase II	5/85	EC Jordan	3	Surface Soil	0-0.5	ug/Kg	<0.23
10	Phase II	5/85	EC Jordan	3	Surface Soil	0-0.5	ug/Kg	<0.29
11	Phase II	5/85	EC Jordan	3	Surface Soil	0-0.5	ug/Kg	<0.16
12	Phase II	5/85	EC Jordan	3	Surface Soil	0-0.5	ug/Kg	0.52
13	Phase II	5/85	EC Jordan	3	Surface Soil	0-0.5	ug/Kg	<0.70
14	Phase II	5/85	EC Jordan	3	Surface Soil	0-0.5	ug/Kg	<0.62
15	Phase II	5/85	EC Jordan	3	Surface Soil	0-0.5	ug/Kg	<0.29
16	Phase II	5/85	EC Jordan	3	Sediment	NA	ug/Kg	59.5
17	Phase II	5/85	EC Jordan	3	Sediment	NA	ug/Kg	--
RB-2A	Supp. Phase II	8/85	Weston	7	Riverbank	0-0.5	ug/Kg	<0.07
RB-2C	Supp. Phase II	8/85	Weston	7	Riverbank	1.5-2	ug/Kg	<0.16
RB-3A	Supp. Phase II	8/85	Weston	7	Riverbank	0-0.5	ug/Kg	<0.1
RB-3B	Supp. Phase II	8/85	Weston	7	Riverbank	1.5-2	ug/Kg	<0.23
LP-1A	Supp. Phase II	8/85	Weston	7	Lagoon Perimeter	0-0.5	ug/Kg	<0.05
LP-1B	Supp. Phase II	8/85	Weston	7	Lagoon Perimeter	1.5-1.7	ug/Kg	<0.12
LP-2	Supp. Phase II	8/85	Weston	7	Lagoon Perimeter	0.0-0.5	ug/Kg	<0.67
LP-3A	Supp. Phase II	8/85	Weston	7	Lagoon Perimeter	0-0.5	ug/Kg	<0.02
LP-3C	Supp. Phase II	8/85	Weston	7	Lagoon Perimeter	3.5-4	ug/Kg	<0.17
LP-4A	Supp. Phase II	8/85	Weston	7	Lagoon Perimeter	0-0.5	ug/Kg	<0.16
LP-4B	Supp. Phase II	8/85	Weston	7	Lagoon Perimeter	6-6.5	ug/Kg	<0.15
LP-5A	Supp. Phase II	8/85	Weston	7	Lagoon Perimeter	0-0.5	ug/Kg	<0.10
LP-5D	Supp. Phase II	8/85	Weston	7	Lagoon Perimeter	3.6-4.1	ug/Kg	<0.01
LP-6A	Supp. Phase II	8/85	Weston	7	Lagoon Perimeter	0-0.5	ug/Kg	<0.03

TABLE 116 - 03
SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION
PREVIOUS INVESTIGATIONS
2,3,7,8-TCDD (DIOXIN)
SITE 116 - STANDARD CHLORINE CHEMICAL COMPANY

Sample ID	Dioxin Program	Date Collected	Collected By	Document* Reference	Sample Type	Depth (bgs)	units	2,3,7,8-TCDD (Dioxin)
LP-6B	Supp. Phase II	8/85	Weston	7	Lagoon Perimeter	1.8-2.2	ug/Kg	<0.05
LP-7A	Supp. Phase II	8/85	Weston	7	Lagoon Perimeter	0-0.5	ug/Kg	<0.09
LP-7B	Supp. Phase II	8/85	Weston	7	Lagoon Perimeter	1.7-2.1	ug/Kg	<0.38
LD-1	Supp. Phase II	8/85	Weston	7	Lagoon	NA	ug/Kg	3.1
EL-1	Supp. Phase II	8/85	Weston	7	Lagoon	0-0.5	ug/Kg	<0.10
EL-3	Supp. Phase II	8/85	Weston	7	Lagoon	0-0.5	ug/Kg	62.1
WL-2	Supp. Phase II	8/85	Weston	7	Other Areas	0-0.5	ug/Kg	<75.5/55.6
10A	Supp. Phase II	8/85	Weston	7	Other Areas	0-0.5	ug/Kg	5
12	Supp. Phase II	8/85	Weston	7	Other Areas	0.5-2	ug/Kg	<0.23
13	Supp. Phase II	8/85	Weston	7	Other Areas	1.5-2	ug/Kg	<0.13
DP-1	Supp. Phase II	8/85	Weston	7	Other Areas	NA	ug/Kg	<0.07
A-1	Stage I	8/85	Weston	4	Core/Spoon sample	0.5-1.5	ug/Kg	2.6
A-2-SS	Stage I	8/85	Weston	4	Surface soil	1.8-2.2	ug/Kg	<1.5
B-1	Stage I	3/87	Weston	4	Core/Spoon sample	0.4-1.2	ug/Kg	8.20
B-2-SS	Stage I	8/85	Weston	4	Surface soil	3.5-4.8	ug/Kg	<0.11
C-1	Stage I	8/85	Weston	4	Core/Spoon sample	0.0-0.8	ug/Kg	19.5
C-2H-SS	Stage I	8/85	Weston	4	Surface soil	1.2-2.1	ug/Kg	0.23
D-1	Stage I	8/85	Weston	4	Core/Spoon sample	0.1-0.9	ug/Kg	<0.9
D-2-SS	Stage I	8/85	Weston	4	Surface soil	2.0-2.5	ug/Kg	<0.053
E-1	Stage I	8/85	Weston	4	Core/Spoon sample	0.0-0.5	ug/Kg	0.850
E-2-SS	Stage I	8/85	Weston	4	Surface soil	0.8-1.3	ug/Kg	31.9
F-4-SS	Stage I	8/85	Weston	4	Surface soil	5.0-5.5	ug/Kg	4.3
G-1	Stage I	8/85	Weston	4	Core/Spoon sample	0.0-0.8	ug/Kg	2.8
G-2-SS	Stage I	8/85	Weston	4	Surface soil	1.5-2.5	ug/Kg	<0.12
H-1	Stage I	8/85	Weston	4	Core/Spoon sample	0.2-1.2	ug/Kg	<0.73
H-2-SS	Stage I	8/85	Weston	4	Surface soil	1.7-2.1	ug/Kg	<0.13
I-1H	Stage I	8/85	Weston	4	Core/Spoon sample	0.0-0.8	ug/Kg	<1.10
I-2-SS	Stage I	8/85	Weston	4	Surface soil	1.3-1.8	ug/Kg	3.2
I-3-SS	Stage I	8/85	Weston	4	Surface soil	2.5-3.5	ug/Kg	38.4

TABLE 116 - 03
SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION
PREVIOUS INVESTIGATIONS
2,3,7,8-TCDD (DIOXIN)
SITE 116 - STANDARD CHLORINE CHEMICAL COMPANY

Sample ID	Dioxin Program	Date Collected	Collected By	Document* Reference	Sample Type	Depth (bgs)	units	2,3,7,8-TCDD (Dioxin)
I-4-SS	Stage I	8/85	Weston	4	Surface soil	4.5-5.5	ug/Kg	6.2
J-1H	Stage I	8/85	Weston	4	Core/Spoon sample	0.1-1.1	ug/Kg	11.2
K-1H-SS	Stage I	8/85	Weston	4	Surface soil	0.1-1.1	ug/Kg	69.6
K-2-SS	Stage I	8/85	Weston	4	Surface soil	1.7-2.2	ug/Kg	2.7
L-1H-SS	Stage I	8/85	Weston	4	Surface soil	0.2-1.2	ug/Kg	0.710
M-1-SS	Stage I	8/85	Weston	4	Surface soil	0.0-0.8	ug/Kg	<0.36
M-2-SS	Stage I	8/85	Weston	4	Surface soil	1.8-2.4	ug/Kg	<0.084
N-1-SS	Stage I	8/85	Weston	4	Surface soil	0.0-0.8	ug/Kg	<0.620
N-2-SS	Stage I	8/85	Weston	4	Surface soil	1.7-2.0	ug/Kg	<0.18
O-1-SS	Stage I	8/85	Weston	4	Surface soil	0.0-1.0	ug/Kg	<0.330
O-2-SS	Stage I	8/85	Weston	4	Surface soil	1.6-2.3	ug/Kg	<0.028
P-1-SS	Stage I	8/85	Weston	4	Surface soil	0.0-0.8	ug/Kg	<0.600
P-2-SS	Stage I	8/85	Weston	4	Surface soil	1.3-1.8	ug/Kg	<0.11
Q-1-SS	Stage I	8/85	Weston	4	Surface soil	0.3-0.8	ug/Kg	<0.56
R-1-SS	Stage I	8/85	Weston	4	Surface soil	0.0-0.8	ug/Kg	15.3
R-2-SS	Stage I	8/85	Weston	4	Surface soil	2.5-3.2	ug/Kg	62.1
S-1-SS	Stage I	8/85	Weston	4	Surface soil	0.3-0.8	ug/Kg	<0.410
SS-1	Stage I	8/85	Weston	4	Surface soil	0-0.5	ug/Kg	<1.1
SS-2	Stage I	8/85	Weston	4	Surface soil	0-0.5	ug/Kg	<1.4
S-2-SS	Stage I	8/85	Weston	4	Surface soil	1.8-2.6	ug/Kg	<0.076
T-1-SS	Stage I	8/85	Weston	4	Surface soil	0.5-1.5	ug/Kg	<0.23
T-2-SS	Stage I	8/85	Weston	4	Surface soil	2.5-3.2	ug/Kg	<0.21
E-3-SS	Stage II & III	8/85	Weston	5	Surface soil	1.6-1.9	ug/Kg	2.9
E-4-SS	Stage II & III	8/85	Weston	5	Surface soil	2.0-2.3	ug/Kg	1.2
F-1	Stage II & III	8/85	Weston	5	Core/Spoon sample	0.0-0.6	ug/Kg	2.3
J-2-SS	Stage II & III	8/85	Weston	5	Surface soil	2.3-2.6	ug/Kg	**
J-3-SS	Stage II & III	8/85	Weston	5	Surface soil	2.9-3.9	ug/Kg	268
J-3-SS	Stage II & III	8/85	Weston	5	Surface soil	2.9-3.9	ug/Kg	237
J-4-SS	Stage II & III	8/85	Weston	5	Surface soil	5.0-5.8	ug/Kg	148

TABLE 116 - 03
SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION
PREVIOUS INVESTIGATIONS
2,3,7,8-TCDD (DIOXIN)
SITE 116 - STANDARD CHLORINE CHEMICAL COMPANY

Sample ID	Dioxin Program	Date Collected	Collected By	Document* Reference	Sample Type	Depth (bgs)	units	2,3,7,8-TCDD (Dioxin)
K-3-SS	Stage II & III	8/85	Weston	5	Surface soil	2.4-3.1	ug/Kg	6.1
K-4-SS	Stage II & III	8/85	Weston	5	Surface soil	4.6-5.6	ug/Kg	3.7
O-2-SS	Stage II & III	8/85	Weston	5	Surface soil	1.6-2.3	ug/Kg	<0.35
R-3-SS	Stage II & III	8/85	Weston	5	Surface soil	4.2-5.0	ug/Kg	190
R-4-SS	Stage II & III	8/85	Weston	5	Surface soil	6.0-6.7	ug/Kg	46
TPS-A1-1	NA	1/00	ES	20	Sediment	1	mg/kg	ND
TPS-A1-5	NA	1/00	ES	20	Sediment	5	mg/kg	ND
TPS-A1-10	NA	1/00	ES	20	Sediment	10	mg/kg	ND
TPS-A2-1	NA	1/00	ES	20	Sediment	1	mg/kg	ND
TPS-A2-5	NA	1/00	ES	20	Sediment	5	mg/kg	ND
TPS-A2-10	NA	1/00	ES	20	Sediment	10	mg/kg	ND
TPS-A3-1	NA	1/00	ES	20	Sediment	1	mg/kg	ND
TPS-A3-5	NA	1/00	ES	20	Sediment	5	mg/kg	ND
TPS-A3-10	NA	1/00	ES	20	Sediment	10	mg/kg	ND
TPS-B1-1	NA	1/00	ES	20	Sediment	1	mg/kg	ND
TPS-B1-5	NA	1/00	ES	20	Sediment	5	mg/kg	ND
TPS-B1-10	NA	1/00	ES	20	Sediment	10	mg/kg	ND
TPS-B2-1	NA	1/00	ES	20	Sediment	1	mg/kg	ND
TPS-B2-5	NA	1/00	ES	20	Sediment	5	mg/kg	ND
TPS-B2-10	NA	1/00	ES	20	Sediment	10	mg/kg	ND
TPS-B3-1	NA	1/00	ES	20	Sediment	1	mg/kg	ND
TPS-B3-5	NA	1/00	ES	20	Sediment	5	mg/kg	ND
TPS-B3-10	NA	1/00	ES	20	Sediment	10	mg/kg	ND
TPS-C1-1	NA	1/00	ES	20	Sediment	1	mg/kg	ND
TPS-C1-5	NA	1/00	ES	20	Sediment	5	mg/kg	ND
TPS-C1-10	NA	1/00	ES	20	Sediment	10	mg/kg	ND
TPS-C2-1	NA	1/00	ES	20	Sediment	1	mg/kg	ND
TPS-C2-5	NA	1/00	ES	20	Sediment	5	mg/kg	ND
TPS-C2-10	NA	1/00	ES	20	Sediment	10	mg/kg	ND

TABLE 116 - 03
SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION
PREVIOUS INVESTIGATIONS
2,3,7,8-TCDD (DIOXIN)
SITE 116 - STANDARD CHLORINE CHEMICAL COMPANY

Sample ID	Dioxin Program	Date Collected	Collected By	Document* Reference	Sample Type	Depth (bgs)	units	2,3,7,8-TCDD (Dioxin)
TPS-C3-1	NA	1/00	ES	20	Sediment	1	mg/kg	ND
TPS-C3-5	NA	1/00	ES	20	Sediment	5	mg/kg	ND
TPS-C3-10	NA	1/00	ES	20	Sediment	10	mg/kg	ND

Notes:
* - Refer to List of Documents (Table 116-01)
**-Liquid phase crystallized before analysis
Weston - Roy F. Weston, Inc.
SS - Surface Soil   ES - Enviro-Sciences, Inc
NA - Not Available   ND - Not Detected
bgs - Below ground surface or sediment surface

TABLE 116 - 04
SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION
PREVIOUS INVESTIGATIONS
VOLATILE ORGANIC COMPOUNDS/SEMIVOLATILE ORGANIC COMPOUNDS
SITE 116 - STANDARD CHLORINE CHEMICAL COMPANY

Sample ID	Date Collected	Collected By	Document* Reference	Sample Type	Units	Methylene Chloride	Trichloro-ethene	Benzene	Tetrachloro-ethene
WLS-1	1/91	Weston	9	Lagoon Sediment	ug/kg	21,500		<15,000	
WLS-2	1/91	Weston	9	Lagoon Sediment	ug/kg	6,090		<4,100	
ELS-1	1/91	Weston	9	Lagoon Sediment	ug/kg	438		896	
ELS-2	1/91	Weston	9	Lagoon Sediment	ug/kg	5,330		23,400	
Tank #1	1/91	Weston	9	Drum Solid	ug/kg	5,920		<4,400	
Tank #2	1/91	Weston	9	Drum Solid	ug/kg	<2,100		<3,200	
Tank #3	1/91	Weston	9	Drum Solid	ug/kg	743		<540	
Tank #4	1/91	Weston	9	Drum Solid	ug/kg	5,190		19,600	
Tank #5	1/91	Weston	9	Drum Solid	ug/kg	<400		<630	
TSS-1	1/91	Weston	9	Soil	ug/kg	<18,000	<12,000	<27,000	<26,000
TSS-2	1/91	Weston	9	Soil	ug/kg	5,690	<2,800	<6,400	<5,900
TSS-3	1/91	Weston	9	Soil	ug/kg	<4.6	<3.1	<7.2	<6.7
TSS-4	1/91	Weston	9	Soil	ug/kg	<2,100	<1,400	<3,300	<3,100
TSS-5	1/91	Weston	9	Soil	ug/kg	114	866	<110	2,310
TSS-6	1/91	Weston	9	Soil	ug/kg	70.8	<33	<76	<71
TSS-7	1/91	Weston	9	Soil	ug/kg	6.57	29.2	<7.5	12.5
TSS-8	1/91	Weston	9	Soil	ug/kg	<4.2	<2.9	<6.7	<6.2
TSS-9	1/91	Weston	9	Soil	ug/kg	7,020	<3,500	<8,100	<7,600
TSS-9D	1/91	Weston	9	Soil	ug/kg	5,980	<2,800	<6,800	<6,100
TSS-10	1/91	Weston	9	Soil	ug/kg	<4.4	<3	<6.9	9.91
SSW/SED-1	1/91	Weston	9	Sediment	ug/kg	13.6		14.9	
SSW/SED-2	1/91	Weston	9	Sediment	ug/kg	<10		<16	
SSW/SED-3	1/91	Weston	9	Sediment	ug/kg	<5,200		<8,100	
SSW/SED-4	1/91	Weston	9	Sediment	ug/kg	15,000		<18,000	
SSW/SED-5	1/91	Weston	9	Sediment	ug/kg	1,360		<1,500	
SED-1	1/91	Weston	9	Sediment	ug/kg	<10		<16	
SED-2	1/91	Weston	9	Sediment	ug/kg	61.1		58.4	
HA3563	1/91	Weston	6	Split Spoon	ug/kg				

TABLE 116 - 04
SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION
PREVIOUS INVESTIGATIONS
VOLATILE ORGANIC COMPOUNDS/SEMIVOLATILE ORGANIC COMPOUNDS
SITE 116 - STANDARD CHLORINE CHEMICAL COMPANY

Sample ID	Date Collected	Collected By	Document* Reference	Sample Type	Units	Methylene Chloride	Trichloro-ethene	Benzene	Tetrachloro-ethene
SED-A1	8/96	ERM	15	Sediment	ug/kg	<6.83	<9.4	<9.4	<9.4
SED-A2	8/96	ERM	15	Sediment	ug/kg	<9.3	<12	<12	<12
SED-A3	8/96	ERM	15	Sediment	ug/kg	<9.9	<14	<4.68	<14
SED-A4	8/96	ERM	15	Sediment	ug/kg	<9.1	<9.1	<9.1	<9.1
SED-B1	8/96	ERM	15	Sediment	ug/kg	<11	<11	<11	<11
SED-B2	8/96	ERM	15	Sediment	ug/kg	<7.6	<7.6	<7.6	<7.6
SED-B3	8/96	ERM	15	Sediment	ug/kg	<7	<7	<7	<7
SED-C1	8/96	ERM	15	Sediment	ug/kg	8.71	<7.9	<7.9	<7.9
SB-01-15.5-16	8/96	ERM	15	Soil Boring	ug/kg				
SB-03-14.5-15	8/96	ERM	15	Soil Boring	ug/kg				
SB-04-15-15.5	8/96	ERM	15	Soil Boring	ug/kg				
SB-07-15.5-16	8/96	ERM	15	Soil Boring	ug/kg				
SB-09-1.5-2	8/96	ERM	15	Soil Boring	ug/kg				
SB-09-15-15.5	8/96	ERM	15	Soil Boring	ug/kg		<5.6		
SB-10R-16-16.5	8/96	ERM	15	Soil Boring	ug/kg				
SB-14-18.5-19	8/96	ERM	15	Soil Boring	ug/kg				
TPS-A1-1	1/00	ES	20	Sediment	ug/kg		ND	ND	ND
TPS-A1-5	1/00	ES	20	Sediment	ug/kg		ND	ND	ND
TPS-A1-10	1/00	ES	20	Sediment	ug/kg		2,750	740	1,980
TPS-A2-1	1/00	ES	20	Sediment	ug/kg		ND	ND	ND
TPS-A2-5	1/00	ES	20	Sediment	ug/kg		ND	ND	ND
TPS-A2-10	1/00	ES	20	Sediment	ug/kg		85,700	4,580 J	123,000
TPS-A3-1	1/00	ES	20	Sediment	ug/kg		ND	ND	ND
TPS-A3-5	1/00	ES	20	Sediment	ug/kg		ND	ND	ND
TPS-A3-10	1/00	ES	20	Sediment	ug/kg		320 J	ND	ND
TPS-B1-1	1/00	ES	20	Sediment	ug/kg				
TPS-B1-5	1/00	ES	20	Sediment	ug/kg				
TPS-B1-10	1/00	ES	20	Sediment	ug/kg				
TPS-B2-1	1/00	ES	20	Sediment	ug/kg				

TABLE 116 - 04
SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION
PREVIOUS INVESTIGATIONS
VOLATILE ORGANIC COMPOUNDS/SEMIVOLATILE ORGANIC COMPOUNDS
SITE 116 - STANDARD CHLORINE CHEMICAL COMPANY

Sample ID	Date Collected	Collected By	Document* Reference	Sample Type	Units	Methylene Chloride	Trichloro-ethene	Benzene	Tetrachloro-ethene
TPS-B2-5	1/00	ES	20	Sediment	ug/kg				
TPS-B2-10	1/00	ES	20	Sediment	ug/kg				
TPS-B3-1	1/00	ES	20	Sediment	ug/kg				
TPS-B3-5	1/00	ES	20	Sediment	ug/kg				
TPS-B3-10	1/00	ES	20	Sediment	ug/kg				
TPS-C1-1	1/00	ES	20	Sediment	ug/kg		ND	ND	ND
TPS-C1-5	1/00	ES	20	Sediment	ug/kg				
TPS-C1-10	1/00	ES	20	Sediment	ug/kg				
TPS-C2-1	1/00	ES	20	Sediment	ug/kg		ND	ND	ND
TPS-C2-5	1/00	ES	20	Sediment	ug/kg				
TPS-C2-10	1/00	ES	20	Sediment	ug/kg				
TPS-C3-1	1/00	ES	20	Sediment	ug/kg		ND	ND	ND
TPS-C3-5	1/00	ES	20	Sediment	ug/kg				
TPS-C3-10	1/00	ES	20	Sediment	ug/kg				
NJDEP Residential Guideline					ug/kg	49,000	23,000	3,000	4,000
NJDEP Non-Residential Guideline					ug/kg	210,000	54,000	13,000	6,000

Notes
SB - Soil Boring   SED, TPS and WLS - Sediment Sample
SSW - Surface Water Sample
-Concentration exceeds NJDEP Residential Guideline
-Concentration exceeds NJDEP Non-Residential Guideline
* - Refer to List of Documents (Table 116-01)
Weston - Roy F. Weston, Inc.
ERM - Environmental Resource Management, Inc.
ES - Enviro-Sciences, Inc.
ND - Not Detected   NA - Not Available
J- Estimated concentration less than detection limit
D - Diluted sample

TABLE 116 - 04
SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION
PREVIOUS INVESTIGATIONS
VOLATILE ORGANIC COMPOUNDS/SEMIVOLATILE ORGANIC COMPOUNDS
SITE 116 - STANDARD CHLORINE CHEMICAL COMPANY

Sample ID	Date Collected	Collected By	Document* Reference	Sample Type	Units	Toluene	Chlorobenzene	Ethylbenzene	Total Xylenes
WLS-1	1/91	Weston	9	Lagoon Sediment	ug/kg	33,800		39,600	
WLS-2	1/91	Weston	9	Lagoon Sediment	ug/kg	15,300		15,200	
ELS-1	1/91	Weston	9	Lagoon Sediment	ug/kg	3,050		2,580	
ELS-2	1/91	Weston	9	Lagoon Sediment	ug/kg	63,100		43,300	
Tank #1	1/91	Weston	9	Drum Solid	ug/kg		<6,000		
Tank #2	1/91	Weston	9	Drum Solid	ug/kg		86,000		
Tank #3	1/91	Weston	9	Drum Solid	ug/kg		<730		
Tank #4	1/91	Weston	9	Drum Solid	ug/kg		335,000		
Tank #5	1/91	Weston	9	Drum Solid	ug/kg		<860		
TSS-1	1/91	Weston	9	Soil	ug/kg		99,600		
TSS-2	1/91	Weston	9	Soil	ug/kg		<8,700		
TSS-3	1/91	Weston	9	Soil	ug/kg		<9.8		
TSS-4	1/91	Weston	9	Soil	ug/kg		5,940		
TSS-5	1/91	Weston	9	Soil	ug/kg		300		
TSS-6	1/91	Weston	9	Soil	ug/kg		<100		
TSS-7	1/91	Weston	9	Soil	ug/kg		<10		
TSS-8	1/91	Weston	9	Soil	ug/kg		<9.1		
TSS-9	1/91	Weston	9	Soil	ug/kg		33,500		
TSS-9D	1/91	Weston	9	Soil	ug/kg		68,400		
TSS-10	1/91	Weston	9	Soil	ug/kg		89.1		
SSW/SED-1	1/91	Weston	9	Sediment	ug/kg	<18	1,484		
SSW/SED-2	1/91	Weston	9	Sediment	ug/kg	<21	38.5		
SSW/SED-3	1/91	Weston	9	Sediment	ug/kg	<11,000	42,100		
SSW/SED-4	1/91	Weston	9	Sediment	ug/kg	<24,000	140,000		
SSW/SED-5	1/91	Weston	9	Sediment	ug/kg	<2,000	9,640		
SED-1	1/91	Weston	9	Sediment	ug/kg	<21	<21		
SED-2	1/91	Weston	9	Sediment	ug/kg	<79	1,950		
HA3563	1/91	Weston	6	Split Spoon	ug/kg		<640		

TABLE 116 - 04
SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION
PREVIOUS INVESTIGATIONS
VOLATILE ORGANIC COMPOUNDS/SEMIVOLATILE ORGANIC COMPOUNDS
SITE 116 - STANDARD CHLORINE CHEMICAL COMPANY

Sample ID	Date Collected	Collected By	Document* Reference	Sample Type	Units	Toluene	Chlorobenzene	Ethylbenzene	Total Xylenes
SED-A1	8/96	ERM	15	Sediment	ug/kg	<9.1	<9.1	<9.1	
SED-A2	8/96	ERM	15	Sediment	ug/kg	<11	33.6	33.6	
SED-A3	8/96	ERM	15	Sediment	ug/kg	<7.6	<11.2	15.7	<7.79
SED-A4	8/96	ERM	15	Sediment	ug/kg	<7	<7	<7	
SED-B1	8/96	ERM	15	Sediment	ug/kg	<7.9	<7.9	<7.9	
SED-B2	8/96	ERM	15	Sediment	ug/kg	<7.6	<7.6	<7.6	
SED-B3	8/96	ERM	15	Sediment	ug/kg	<7	<7	<7	
SED-C1	8/96	ERM	15	Sediment	ug/kg	<7.9	<7.9	<7.9	
SB-01-15.5-16	8/96	ERM	15	Soil Boring	ug/kg				
SB-03-14.5-15	8/96	ERM	15	Soil Boring	ug/kg				
SB-04-15-15.5	8/96	ERM	15	Soil Boring	ug/kg				
SB-07-15.5-16	8/96	ERM	15	Soil Boring	ug/kg				
SB-09-1.5-2	8/96	ERM	15	Soil Boring	ug/kg				
SB-09-15-15.5	8/96	ERM	15	Soil Boring	ug/kg		<42,600		
SB-10R-16-16.5	8/96	ERM	15	Soil Boring	ug/kg				<44,300
SB-14-18.5-19	8/96	ERM	15	Soil Boring	ug/kg		<3.49		
TPS-A1-1	1/00	ES	20	Sediment	ug/kg	ND	ND		ND
TPS-A1-5	1/00	ES	20	Sediment	ug/kg		ND		
TPS-A1-10	1/00	ES	20	Sediment	ug/kg		5,170		
TPS-A2-1	1/00	ES	20	Sediment	ug/kg	ND	ND		ND
TPS-A2-5	1/00	ES	20	Sediment	ug/kg		ND		
TPS-A2-10	1/00	ES	20	Sediment	ug/kg		1,460,000 D		
TPS-A3-1	1/00	ES	20	Sediment	ug/kg	ND	6,260 J		ND
TPS-A3-5	1/00	ES	20	Sediment	ug/kg		ND		
TPS-A3-10	1/00	ES	20	Sediment	ug/kg		ND		
TPS-B1-1	1/00	ES	20	Sediment	ug/kg	ND	ND		ND
TPS-B1-5	1/00	ES	20	Sediment	ug/kg	ND	ND		
TPS-B1-10	1/00	ES	20	Sediment	ug/kg	220 J	ND		
TPS-B2-1	1/00	ES	20	Sediment	ug/kg	ND	ND		ND

TABLE 116 - 04
SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION
PREVIOUS INVESTIGATIONS
VOLATILE ORGANIC COMPOUNDS/SEMIVOLATILE ORGANIC COMPOUNDS
SITE 116 - STANDARD CHLORINE CHEMICAL COMPANY

Sample ID	Date Collected	Collected By	Document* Reference	Sample Type	Units	Toluene		Chlorobenzene		Ethylbenzene	Total Xylenes
TPS-B2-5	1/00	ES	20	Sediment	ug/kg	ND		ND			
TPS-B2-10	1/00	ES	20	Sediment	ug/kg	ND		ND			
TPS-B3-1	1/00	ES	20	Sediment	ug/kg	380	J	690	J		ND
TPS-B3-5	1/00	ES	20	Sediment	ug/kg	ND		ND			
TPS-B3-10	1/00	ES	20	Sediment	ug/kg	ND		ND			
TPS-C1-1	1/00	ES	20	Sediment	ug/kg						ND
TPS-C1-5	1/00	ES	20	Sediment	ug/kg						
TPS-C1-10	1/00	ES	20	Sediment	ug/kg						
TPS-C2-1	1/00	ES	20	Sediment	ug/kg						ND
TPS-C2-5	1/00	ES	20	Sediment	ug/kg						
TPS-C2-10	1/00	ES	20	Sediment	ug/kg						
TPS-C3-1	1/00	ES	20	Sediment	ug/kg						ND
TPS-C3-5	1/00	ES	20	Sediment	ug/kg						
TPS-C3-10	1/00	ES	20	Sediment	ug/kg						
NJDEP Residential Guideline					ug/kg	1,000,000		37,000		1,000,000	410,000
NJDEP Non-Residential Guideline					ug/kg	1,000,000		680,000		1,000,000	1,000,000

Notes
SB - Soil Boring SED, TPS and WLS - Sediment Sample
SSW - Surface Water Sample
-Concentration exceeds NJDEP Residential Guideline
-Concentration exceeds NJDEP Non-Residential Guideline
* - Refer to List of Documents (Table 116-01)
Weston - Roy F. Weston, Inc.
ERM - Environmental Resource Management, Inc.
ES - Enviro-Sciences, Inc.
ND - Not Detected NA - Not Available
J- Estimated concentration less than detection limit
D - Diluted sample

TABLE 116 - 04
SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION
PREVIOUS INVESTIGATIONS
VOLATILE ORGANIC COMPOUNDS/SEMIVOLATILE ORGANIC COMPOUNDS
SITE 116 - STANDARD CHLORINE CHEMICAL COMPANY

Sample ID	Date Collected	Collected By	Document* Reference	Sample Type	Units	1,2,3-Trichlorobenzene	1,2,4-Trichlorobenzene	1,2,4-Trimethylbenzene
WLS-1	1/91	Weston	9	Lagoon Sediment	ug/kg			
WLS-2	1/91	Weston	9	Lagoon Sediment	ug/kg			
ELS-1	1/91	Weston	9	Lagoon Sediment	ug/kg			
ELS-2	1/91	Weston	9	Lagoon Sediment	ug/kg			
Tank #1	1/91	Weston	9	Drum Solid	ug/kg		465,000,000	
Tank #2	1/91	Weston	9	Drum Solid	ug/kg		225,000,000	
Tank #3	1/91	Weston	9	Drum Solid	ug/kg		70,400,000	
Tank #4	1/91	Weston	9	Drum Solid	ug/kg		160,000,000	
Tank #5	1/91	Weston	9	Drum Solid	ug/kg		47,700,000	
TSS-1	1/91	Weston	9	Soil	ug/kg		75,000,000	
TSS-2	1/91	Weston	9	Soil	ug/kg		3,040,000	
TSS-3	1/91	Weston	9	Soil	ug/kg		6,360	
TSS-4	1/91	Weston	9	Soil	ug/kg		14,100,000	
TSS-5	1/91	Weston	9	Soil	ug/kg		68,200,000	
TSS-6	1/91	Weston	9	Soil	ug/kg		30,100	
TSS-7	1/91	Weston	9	Soil	ug/kg		25,400	
TSS-8	1/91	Weston	9	Soil	ug/kg		28,300	
TSS-9	1/91	Weston	9	Soil	ug/kg		100,000,000	
TSS-9D	1/91	Weston	9	Soil	ug/kg		200,000,000	
TSS-10	1/91	Weston	9	Soil	ug/kg		62,800	
SSW/SED-1	1/91	Weston	9	Sediment	ug/kg		<5,600	
SSW/SED-2	1/91	Weston	9	Sediment	ug/kg		<680	
SSW/SED-3	1/91	Weston	9	Sediment	ug/kg		190,000	
SSW/SED-4	1/91	Weston	9	Sediment	ug/kg		257,000	
SSW/SED-5	1/91	Weston	9	Sediment	ug/kg		<13,000	
SED-1	1/91	Weston	9	Sediment	ug/kg		776	
SED-2	1/91	Weston	9	Sediment	ug/kg		60,200	
HA3563	1/91	Weston	6	Split Spoon	ug/kg			

TABLE 116 - 04
SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION
PREVIOUS INVESTIGATIONS
VOLATILE ORGANIC COMPOUNDS/SEMIVOLATILE ORGANIC COMPOUNDS
SITE 116 - STANDARD CHLORINE CHEMICAL COMPANY

Sample ID	Date Collected	Collected By	Document* Reference	Sample Type	Units	1,2,3-Trichlorobenzene	1,2,4-Trichlorobenzene	1,2,4-Trimethylbenzene
SED-A1	8/96	ERM	15	Sediment	ug/kg	<9.1	<9.1	<9.1
SED-A2	8/96	ERM	15	Sediment	ug/kg	<11.1	40.5	<4.51
SED-A3	8/96	ERM	15	Sediment	ug/kg	18.7	61.1	40.4
SED-A4	8/96	ERM	15	Sediment	ug/kg	<7	<7	<7
SED-B1	8/96	ERM	15	Sediment	ug/kg	<7.9	<7.9	<7.9
SED-B2	8/96	ERM	15	Sediment	ug/kg	<7.6	<7.6	<7.6
SED-B3	8/96	ERM	15	Sediment	ug/kg	<7	<7	<7
SED-C1	8/96	ERM	15	Sediment	ug/kg	<7.9	<7.9	<7.9
SB-01-15.5-16	8/96	ERM	15	Soil Boring	ug/kg		<2	
SB-03-14.5-15	8/96	ERM	15	Soil Boring	ug/kg	1,770,000	6,540,000	
SB-04-15-15.5	8/96	ERM	15	Soil Boring	ug/kg	1,000,000	1,870,000	
SB-07-15.5-16	8/96	ERM	15	Soil Boring	ug/kg			65,500
SB-09-1.5-2	8/96	ERM	15	Soil Boring	ug/kg	32.6	20.3	
SB-09-15-15.5	8/96	ERM	15	Soil Boring	ug/kg	345,000	1,180,000	
SB-10R-16-16.5	8/96	ERM	15	Soil Boring	ug/kg	2,140,000	2,290,000	<60,800
SB-14-18.5-19	8/96	ERM	15	Soil Boring	ug/kg	91.9	350	<2.15
TPS-A1-1	1/00	ES	20	Sediment	ug/kg		ND	
TPS-A1-5	1/00	ES	20	Sediment	ug/kg		11,00	
TPS-A1-10	1/00	ES	20	Sediment	ug/kg		180	
TPS-A2-1	1/00	ES	20	Sediment	ug/kg		ND	
TPS-A2-5	1/00	ES	20	Sediment	ug/kg		ND	
TPS-A2-10	1/00	ES	20	Sediment	ug/kg		43,200	
TPS-A3-1	1/00	ES	20	Sediment	ug/kg		ND	
TPS-A3-5	1/00	ES	20	Sediment	ug/kg		ND	
TPS-A3-10	1/00	ES	20	Sediment	ug/kg		2,970	
TPS-B1-1	1/00	ES	20	Sediment	ug/kg			
TPS-B1-5	1/00	ES	20	Sediment	ug/kg			
TPS-B1-10	1/00	ES	20	Sediment	ug/kg			
TPS-B2-1	1/00	ES	20	Sediment	ug/kg			

TABLE 116 - 04
SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION
PREVIOUS INVESTIGATIONS
VOLATILE ORGANIC COMPOUNDS/SEMIVOLATILE ORGANIC COMPOUNDS
SITE 116 - STANDARD CHLORINE CHEMICAL COMPANY

Sample ID	Date Collected	Collected By	Document* Reference	Sample Type	Units	1,2,3-Trichlorobenzene	1,2,4-Trichlorobenzene	1,2,4-Trimethylbenzene
TPS-B2-5	1/00	ES	20	Sediment	ug/kg			
TPS-B2-10	1/00	ES	20	Sediment	ug/kg			
TPS-B3-1	1/00	ES	20	Sediment	ug/kg			
TPS-B3-5	1/00	ES	20	Sediment	ug/kg			
TPS-B3-10	1/00	ES	20	Sediment	ug/kg			
TPS-C1-1	1/00	ES	20	Sediment	ug/kg			
TPS-C1-5	1/00	ES	20	Sediment	ug/kg			
TPS-C1-10	1/00	ES	20	Sediment	ug/kg			
TPS-C2-1	1/00	ES	20	Sediment	ug/kg			
TPS-C2-5	1/00	ES	20	Sediment	ug/kg			
TPS-C2-10	1/00	ES	20	Sediment	ug/kg			
TPS-C3-1	1/00	ES	20	Sediment	ug/kg			
TPS-C3-5	1/00	ES	20	Sediment	ug/kg			
TPS-C3-10	1/00	ES	20	Sediment	ug/kg			
NJDEP Residential Guideline					ug/kg	NA	68,000	NA
NJDEP Non-Residential Guideline					ug/kg	NA	1,200,000	NA

Notes
SB - Soil Boring SED, TPS and WLS - Sediment Sample
SSW - Surface Water Sample
-Concentration exceeds NJDEP Residential Guideline
-Concentration exceeds NJDEP Non-Residential Guideline
* - Refer to List of Documents (Table 116-01)
Weston - Roy F. Weston, Inc.
ERM - Environmental Resource Management, Inc.
ES - Enviro-Sciences, Inc.
ND - Not Detected NA - Not Available
J- Estimated concentration less than detection limit
D - Diluted sample

TABLE 116 - 04
SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION
PREVIOUS INVESTIGATIONS
VOLATILE ORGANIC COMPOUNDS/SEMIVOLATILE ORGANIC COMPOUNDS
SITE 116 - STANDARD CHLORINE CHEMICAL COMPANY

Sample ID	Date Collected	Collected By	Document* Reference	Sample Type	Units	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene
WLS-1	1/91	Weston	9	Lagoon Sediment	ug/kg	<130,000	<130,000	<290,000
WLS-2	1/91	Weston	9	Lagoon Sediment	ug/kg	<170,000	<170,000	<400,000
ELS-1	1/91	Weston	9	Lagoon Sediment	ug/kg	22,100	<5,800	40,000
ELS-2	1/91	Weston	9	Lagoon Sediment	ug/kg	<290,000	<290,000	<660,000
Tank #1	1/91	Weston	9	Drum Solid	ug/kg	138,000	41,600	61,300
Tank #2	1/91	Weston	9	Drum Solid	ug/kg	2,540,000	210,000	557,000
Tank #3	1/91	Weston	9	Drum Solid	ug/kg	<4,600	<4,600	<11,000
Tank #4	1/91	Weston	9	Drum Solid	ug/kg	3,570,000	375,000	811,000
Tank #5	1/91	Weston	9	Drum Solid	ug/kg	48,400	3,480	12,500
TSS-1	1/91	Weston	9	Soil	ug/kg	3,850,000	1,210,000	2,230,000
TSS-2	1/91	Weston	9	Soil	ug/kg	4,680,000	738,000	4,840,000
TSS-3	1/91	Weston	9	Soil	ug/kg	12,100	14,500	54,600
TSS-4	1/91	Weston	9	Soil	ug/kg	34,400	9,590	15,000
TSS-5	1/91	Weston	9	Soil	ug/kg	522,000	394,000	52,200
TSS-6	1/91	Weston	9	Soil	ug/kg	10,800	9,500	15,700
TSS-7	1/91	Weston	9	Soil	ug/kg	3,780	6,400	<7,400
TSS-8	1/91	Weston	9	Soil	ug/kg	<2,900	<2,900	<6,600
TSS-9	1/91	Weston	9	Soil	ug/kg	4,340,000	1,270,000	876,000
TSS-9D	1/91	Weston	9	Soil	ug/kg	6,470,000	1,550,000	1,200,000
TSS-10	1/91	Weston	9	Soil	ug/kg	6,530	66,200	41,700
SSW/SED-1	1/91	Weston	9	Sediment	ug/kg	<5,600	<5,600	<13,000
SSW/SED-2	1/91	Weston	9	Sediment	ug/kg	<680	<680	<1,600
SSW/SED-3	1/91	Weston	9	Sediment	ug/kg	723,000	593,000	637,000
SSW/SED-4	1/91	Weston	9	Sediment	ug/kg	1,070,000	1,010,000	1,170,000
SSW/SED-5	1/91	Weston	9	Sediment	ug/kg	13,300	35,200	48,500
SED-1	1/91	Weston	9	Sediment	ug/kg	<680	1,470	2,090
SED-2	1/91	Weston	9	Sediment	ug/kg	125,000	109,000	202,000
HA3563	1/91	Weston	6	Split Spoon	ug/kg	1,140	833	1,290

TABLE 116 - 04
SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION
PREVIOUS INVESTIGATIONS
VOLATILE ORGANIC COMPOUNDS/SEMIVOLATILE ORGANIC COMPOUNDS
SITE 116 - STANDARD CHLORINE CHEMICAL COMPANY

Sample ID	Date Collected	Collected By	Document* Reference	Sample Type	Units	1,2-Dichlorobenzene		1,3-Dichlorobenzene		1,4-Dichlorobenzene	
SED-A1	8/96	ERM	15	Sediment	ug/kg	<4.19		18.7		45.4	
SED-A2	8/96	ERM	15	Sediment	ug/kg	160		145		212	
SED-A3	8/96	ERM	15	Sediment	ug/kg	164		69.6		160	
SED-A4	8/96	ERM	15	Sediment	ug/kg	<7.67		31.5		79.1	
SED-B1	8/96	ERM	15	Sediment	ug/kg	<4.78		<4.45		<10.80	
SED-B2	8/96	ERM	15	Sediment	ug/kg	<1.95		<1.62		<3.73	
SED-B3	8/96	ERM	15	Sediment	ug/kg	<7		<7		<2.03	
SED-C1	8/96	ERM	15	Sediment	ug/kg	<7.9		9.11		<6.17	
SB-01-15.5-16	8/96	ERM	15	Soil Boring	ug/kg	115		43			
SB-03-14.5-15	8/96	ERM	15	Soil Boring	ug/kg	1,080,000		1,700,000		1,630,000	
SB-04-15-15.5	8/96	ERM	15	Soil Boring	ug/kg	1,310,000		<433,000		677,000	
SB-07-15.5-16	8/96	ERM	15	Soil Boring	ug/kg						
SB-09-1.5-2	8/96	ERM	15	Soil Boring	ug/kg	<5.98		<3.29		<5.59	
SB-09-15-15.5	8/96	ERM	15	Soil Boring	ug/kg	506,000		210,000		257,000	
SB-10R-16-16.5	8/96	ERM	15	Soil Boring	ug/kg	2,320,000		557,000		1,160,000	
SB-14-18.5-19	8/96	ERM	15	Soil Boring	ug/kg	70.2		50.9		53.5	
TPS-A1-1	1/00	ES	20	Sediment	ug/kg	ND		ND		ND	
TPS-A1-5	1/00	ES	20	Sediment	ug/kg	ND		ND		ND	
TPS-A1-10	1/00	ES	20	Sediment	ug/kg	13,400		29,700		26,400	
TPS-A2-1	1/00	ES	20	Sediment	ug/kg	ND		ND		ND	
TPS-A2-5	1/00	ES	20	Sediment	ug/kg	ND		ND		ND	
TPS-A2-10	1/00	ES	20	Sediment	ug/kg	766,000	D	759,000	D	1,460,000	D
TPS-A3-1	1/00	ES	20	Sediment	ug/kg	ND		ND		ND	
TPS-A3-5	1/00	ES	20	Sediment	ug/kg	ND		ND		ND	
TPS-A3-10	1/00	ES	20	Sediment	ug/kg	2,230		840		860	
TPS-B1-1	1/00	ES	20	Sediment	ug/kg	ND		ND		ND	
TPS-B1-5	1/00	ES	20	Sediment	ug/kg	ND		ND		ND	
TPS-B1-10	1/00	ES	20	Sediment	ug/kg	ND		ND		ND	
TPS-B2-1	1/00	ES	20	Sediment	ug/kg	ND		ND		ND	

TABLE 116 - 04
SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION
PREVIOUS INVESTIGATIONS
VOLATILE ORGANIC COMPOUNDS/SEMIVOLATILE ORGANIC COMPOUNDS
SITE 116 - STANDARD CHLORINE CHEMICAL COMPANY

Sample ID	Date Collected	Collected By	Document* Reference	Sample Type	Units	1.2- Dichlorobenzene	1,3- Dichlorobenzene	1,4- Dichlorobenzene
TPS-B2-5	1/00	ES	20	Sediment	ug/kg	ND	ND	ND
TPS-B2-10	1/00	ES	20	Sediment	ug/kg	290	220 J	470
TPS-B3-1	1/00	ES	20	Sediment	ug/kg	ND	ND	ND
TPS-B3-5	1/00	ES	20	Sediment	ug/kg	ND	ND	ND
TPS-B3-10	1/00	ES	20	Sediment	ug/kg	ND	ND	ND
TPS-C1-1	1/00	ES	20	Sediment	ug/kg			
TPS-C1-5	1/00	ES	20	Sediment	ug/kg			
TPS-C1-10	1/00	ES	20	Sediment	ug/kg			
TPS-C2-1	1/00	ES	20	Sediment	ug/kg			
TPS-C2-5	1/00	ES	20	Sediment	ug/kg			
TPS-C2-10	1/00	ES	20	Sediment	ug/kg			
TPS-C3-1	1/00	ES	20	Sediment	ug/kg			
TPS-C3-5	1/00	ES	20	Sediment	ug/kg			
TPS-C3-10	1/00	ES	20	Sediment	ug/kg			
NJDEP Residential Guideline					ug/kg	5,100,000	5,100,000	570,000
NJDEP Non-Residential Guideline					ug/kg	10,000,000	10,000,000	10,000,000

Notes
SB - Soil Boring SED, TPS and WLS - Sediment Sample
SSW - Surface Water Sample
-Concentration exceeds NJDEP Residential Guideline
-Concentration exceeds NJDEP Non-Residential Guideline
* - Refer to List of Documents (Table 116-01)
Weston - Roy F. Weston, Inc.
ERM - Environmental Resource Management, Inc.
ES - Enviro-Sciences, Inc.
ND - Not Detected NA - Not Available
J- Estimated concentration less than detection limit
D - Diluted sample

TABLE 116 - 04
SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION
PREVIOUS INVESTIGATIONS
VOLATILE ORGANIC COMPOUNDS/SEMIVOLATILE ORGANIC COMPOUNDS
SITE 116 - STANDARD CHLORINE CHEMICAL COMPANY

Sample ID	Date Collected	Collected By	Document* Reference	Sample Type	Units	Butyl-benzene	Cumene	p-Cymen	Naphthalene
WLS-1	1/91	Weston	9	Lagoon Sediment	ug/kg				2,040,000,000
WLS-2	1/91	Weston	9	Lagoon Sediment	ug/kg				300,000,000
ELS-1	1/91	Weston	9	Lagoon Sediment	ug/kg				815,000,000
ELS-2	1/91	Weston	9	Lagoon Sediment	ug/kg				25,200,000,000
Tank #1	1/91	Weston	9	Drum Solid	ug/kg				
Tank #2	1/91	Weston	9	Drum Solid	ug/kg				
Tank #3	1/91	Weston	9	Drum Solid	ug/kg				
Tank #4	1/91	Weston	9	Drum Solid	ug/kg				
Tank #5	1/91	Weston	9	Drum Solid	ug/kg				
TSS-1	1/91	Weston	9	Soil	ug/kg				2,370,000,000
TSS-2	1/91	Weston	9	Soil	ug/kg				167,000
TSS-3	1/91	Weston	9	Soil	ug/kg				191,000
TSS-4	1/91	Weston	9	Soil	ug/kg				5,020
TSS-5	1/91	Weston	9	Soil	ug/kg				<4,100
TSS-6	1/91	Weston	9	Soil	ug/kg				51,800
TSS-7	1/91	Weston	9	Soil	ug/kg				7,310
TSS-8	1/91	Weston	9	Soil	ug/kg				16,700
TSS-9	1/91	Weston	9	Soil	ug/kg				<3,000
TSS-9D	1/91	Weston	9	Soil	ug/kg				<2,400
TSS-10	1/91	Weston	9	Soil	ug/kg				448,000
SSW/SED-1	1/91	Weston	9	Sediment	ug/kg				<4,700
SSW/SED-2	1/91	Weston	9	Sediment	ug/kg				879
SSW/SED-3	1/91	Weston	9	Sediment	ug/kg				234,000
SSW/SED-4	1/91	Weston	9	Sediment	ug/kg				8,800
SSW/SED-5	1/91	Weston	9	Sediment	ug/kg				<11,000
SED-1	1/91	Weston	9	Sediment	ug/kg				<570
SED-2	1/91	Weston	9	Sediment	ug/kg				<2,100
HA3563	1/91	Weston	6	Split Spoon	ug/kg				3,220

TABLE 116 - 04
SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION
PREVIOUS INVESTIGATIONS
VOLATILE ORGANIC COMPOUNDS/SEMIVOLATILE ORGANIC COMPOUNDS
SITE 116 - STANDARD CHLORINE CHEMICAL COMPANY

Sample ID	Date Collected	Collected By	Document* Reference	Sample Type	Units	Butyl-benzene	Cumene	p-Cymen	Naphthalene
SED-A1	8/96	ERM	15	Sediment	ug/kg	<4.19	<4.19	<4.19	<2.58
SED-A2	8/96	ERM	15	Sediment	ug/kg	<6.52	<5.52	<7.91	33.5
SED-A3	8/96	ERM	15	Sediment	ug/kg	<14	17.3	42.8	367
SED-A4	8/96	ERM	15	Sediment	ug/kg	<7.67	<7.67	<7.67	
SED-B1	8/96	ERM	15	Sediment	ug/kg	<4.78	<4.78	<4.78	<3.57
SED-B2	8/96	ERM	15	Sediment	ug/kg	<1.95	<1.95	<1.95	<6.88
SED-B3	8/96	ERM	15	Sediment	ug/kg	<7	<7	<7	<0.74
SED-C1	8/96	ERM	15	Sediment	ug/kg	<7.9	<7.9	<7.9	
SB-01-15.5-16	8/96	ERM	15	Soil Boring	ug/kg				
SB-03-14.5-15	8/96	ERM	15	Soil Boring	ug/kg				
SB-04-15-15.5	8/96	ERM	15	Soil Boring	ug/kg	<57,800			
SB-07-15.5-16	8/96	ERM	15	Soil Boring	ug/kg				
SB-09-1.5-2	8/96	ERM	15	Soil Boring	ug/kg				
SB-09-15-15.5	8/96	ERM	15	Soil Boring	ug/kg				
SB-10R-16-16.5	8/96	ERM	15	Soil Boring	ug/kg				
SB-14-18.5-19	8/96	ERM	15	Soil Boring	ug/kg				
TPS-A1-1	1/00	ES	20	Sediment	ug/kg				200,000
TPS-A1-5	1/00	ES	20	Sediment	ug/kg				323
TPS-A1-10	1/00	ES	20	Sediment	ug/kg				ND
TPS-A2-1	1/00	ES	20	Sediment	ug/kg				480
TPS-A2-5	1/00	ES	20	Sediment	ug/kg				ND
TPS-A2-10	1/00	ES	20	Sediment	ug/kg				40,900
TPS-A3-1	1/00	ES	20	Sediment	ug/kg				460
TPS-A3-5	1/00	ES	20	Sediment	ug/kg				340
TPS-A3-10	1/00	ES	20	Sediment	ug/kg				290
TPS-B1-1	1/00	ES	20	Sediment	ug/kg				4,570,000
TPS-B1-5	1/00	ES	20	Sediment	ug/kg				26,300
TPS-B1-10	1/00	ES	20	Sediment	ug/kg				ND
TPS-B2-1	1/00	ES	20	Sediment	ug/kg				730

TABLE 116 - 04
SUMMARY OF SOIL AND SEDIMENT CHARACTERIZATION
PREVIOUS INVESTIGATIONS
VOLATILE ORGANIC COMPOUNDS/SEMIVOLATILE ORGANIC COMPOUNDS
SITE 116 - STANDARD CHLORINE CHEMICAL COMPANY

Sample ID	Date Collected	Collected By	Document* Reference	Sample Type	Units	Butyl-benzene	Cumene	p-Cymen	Naphthalene
TPS-B2-5	1/00	ES	20	Sediment	ug/kg				ND
TPS-B2-10	1/00	ES	20	Sediment	ug/kg				2,570
TPS-B3-1	1/00	ES	20	Sediment	ug/kg				3,940
TPS-B3-5	1/00	ES	20	Sediment	ug/kg				130
TPS-B3-10	1/00	ES	20	Sediment	ug/kg				ND
TPS-C1-1	1/00	ES	20	Sediment	ug/kg				28,300
TPS-C1-5	1/00	ES	20	Sediment	ug/kg				400
TPS-C1-10	1/00	ES	20	Sediment	ug/kg				ND
TPS-C2-1	1/00	ES	20	Sediment	ug/kg				21,100
TPS-C2-5	1/00	ES	20	Sediment	ug/kg				ND
TPS-C2-10	1/00	ES	20	Sediment	ug/kg				ND
TPS-C3-1	1/00	ES	20	Sediment	ug/kg				ND
TPS-C3-5	1/00	ES	20	Sediment	ug/kg				ND
TPS-C3-10	1/00	ES	20	Sediment	ug/kg				ND
NJDEP Residential Guideline					ug/kg	NA	NA		230,000
NJDEP Non-Residential Guideline					ug/kg	NA	NA		4,200,000

Notes
SB - Soil Boring SED, TPS and WLS - Sediment Sample
SSW - Surface Water Sample
-Concentration exceeds NJDEP Residential Guideline
-Concentration exceeds NJDEP Non-Residential Guideline
* - Refer to List of Documents (Table 116-01)
Weston - Roy F. Weston, Inc.
ERM - Environmental Resource Management, Inc.
ES - Enviro-Sciences, Inc.
ND - Not Detected NA - Not Available
J- Estimated concentration less than detection limit
D - Diluted sample

TABLE 116 - 05
SUMMARY OF GROUNDWATER AND SURFACE WATER CHARACTERIZATION
PREVIOUS INVESTIGATIONS
TOTAL AND HEXAVALENT CHROMIUM
SITE 116 - STANDARD CHLORINE CHEMICAL COMPANY

Sample ID	Date Collected	Collected By	Document* Reference	Sample Type	Units	Total Cr	Cr(VI)
MW-1S	8/83	Weston	7	Groundwater	ug/L	<50	<100
MW-1D	8/83	Weston	7	Groundwater	ug/L	<50	<100
MW-2S	8/83	Weston	7	Groundwater	ug/L	7,700	<100
MW-2D	8/83	Weston	7	Groundwater	ug/L	300	<100
MW-3S	8/83	Weston	7	Groundwater	ug/L	290	<100
MW-3D	8/83	Weston	7	Groundwater	ug/L	60	<100
MW-4S	8/83	Weston	7	Groundwater	ug/L	101,700	97,000
MW-4D	8/83	Weston	7	Groundwater	ug/L	440	<100
MW-5S	8/83	Weston	7	Groundwater	ug/L	IS	IS
MW-5D	8/83	Weston	7	Groundwater	ug/L	44,300	<100
HA3597	1/91	Weston	9	West Lagoon	ug/L	300	NR
HA3598	1/91	Weston	9	East Lagoon	ug/L	2,840	NR
SSW-1	1/91	Weston	9	Surface Water	ug/L	6,290	NR
SSW-2	1/91	Weston	9	Surface Water	ug/L	320	NR
SSW-3	1/91	Weston	9	Surface Water	ug/L	480	NR
SSW-4	1/91	Weston	9	Surface Water	ug/L	8,640	NR
SSW-5	1/91	Weston	9	Surface Water	ug/L	160	NR
MW-1L	1/91	Weston	9	Groundwater	ug/L	1,870	<50
MW-2L	1/91	Weston	9	Groundwater	ug/L	39	<50
MW-3L	1/91	Weston	9	Groundwater	ug/L	14	<50
MW-4L	1/91	Weston	9	Groundwater	ug/L	1,400	<50
MW-4L	1992	Weston	16	Groundwater	ug/L	1,210	NR
MW-5L	1/91	Weston	9	Groundwater	ug/L	1,890	<10
MW-5L	1992	Weston	16	Groundwater	ug/L	5,100	NR
MW-6L	1/91	Weston	9	Groundwater	ug/L	180	<10
MW-7L	1/91	Weston	9	Groundwater	ug/L	870	<500
MW-8L	1/91	Weston	9	Groundwater	ug/L	710	<50
MW-8L	1992	Weston	16	Groundwater	ug/L	1,460	NR
MW-9L	1/91	Weston	9	Groundwater	ug/L	15,800	<500
MW-9L	1992	Weston	16	Groundwater	ug/L	9,560	NR
MW-10L	1/91	Weston	9	Groundwater	ug/L	4,910	<50
MW-10L	1992	Weston	16	Groundwater	ug/L	1,290	NR
MW-11L	1/91	Weston	9	Groundwater	ug/L	1,160	<10
MW-11U	1/91	Weston	9	Groundwater	ug/L	6,640	<10
MW-12L	1/91	Weston	9	Groundwater	ug/L	170	<10
MW-12L	1992	Weston	15	Groundwater	ug/L	118	NR
MW-12U	1/91	Weston	9	Groundwater	ug/L	2,300	81
MW-13L	1/91	Weston	9	Groundwater	ug/L	67,300	<50
MW-13U	1/91	Weston	9	Groundwater	ug/L	7,150	7,380
MW-14L	1/91	Weston	9	Groundwater	ug/L	900	<10
MW-14L	1992	Weston	15	Groundwater	ug/L	778	NR
MW-14U	1/91	Weston	9	Groundwater	ug/L	20,300	3,320

TABLE 116 - 05
SUMMARY OF GROUNDWATER AND SURFACE WATER CHARACTERIZATION
PREVIOUS INVESTIGATIONS
TOTAL AND HEXAVALENT CHROMIUM
SITE 116 - STANDARD CHLORINE CHEMICAL COMPANY

Sample ID	Date Collected	Collected By	Document* Reference	Sample Type	Units	Total Cr	Cr(VI)
MW-15L	1/91	Weston	9	Groundwater	ug/L	23	<10
MW-15U	1/91	Weston	9	Groundwater	ug/L	$\boxed{4,200}$	88
TANK 4	5/93	Weston	12	Septic Tank	ug/L	13.5	NR
TANK 5	5/93	Weston	12	Septic Tank	ug/L	19	NR
TANK 6	5/93	Weston	12	Septic Tank	ug/L	67.7	NR
TANK 7	5/93	Weston	12	Septic Tank	ug/L	33.7	NR
116-SW-1-F(a)	4/00	B&C	19	Surface Water	ug/L	91	54
116-SW-1-T(a)	4/00	B&C	19	Surface Water	ug/L	422	40
116-SW-2-F(b)	4/00	B&C	19	Surface Water	ug/L	24	15
116-SW-2-T(b)	4/00	B&C	19	Surface Water	ug/L	85	41

Notes:

IS - Insufficient Sample
SW - Surface Water
L - Deep Well
Weston - Roy F. Weston, Inc.
B&C - Brown and Caldwell
(a) - Drainage ditch in south central portion of site
(b) - Southern perimeter drainage ditch near outfall to Hackensack River

S - Shallow Well
U -Shallow Well
D - Deep Well

NR - Not Requested or Reported
SSW - Surface Water
*-Refer to List of Documents (Table 116-01)
[box] -Concentration exceeds NJGWQS of 100 ug/L.
[box] -Concentration exceeds NJSWQS of 3,230 µg/L.

TABLE 116 - 06
SUMMARY OF GROUNDWATER AND SURFACE WATER CHARACTERIZATION
PREVIOUS INVESTIGATIONS
VOLATILE ORGANIC COMPOUNDS/SEMI-VOLATILE ORGANIC COMPOUNDS
SITE 116 - STANDARD CHLORINE CHEMICAL COMPANY

Sample ID	Date Collected	Collected By	Document* Reference	Sample Type	Units	Vinyl Chloride	Methylene Chloride	trans - 1,2-Dichloroethene	Trichloro-ethene	1,1,2-Trichloro-ethane	Benzene
MW-1S	8/83	Weston	2	Groundwater	ug/L			ND	ND	ND	ND
MW-1D	8/83	Weston	2	Groundwater	ug/L			ND	ND	ND	125
MW-2S	8/83	Weston	2	Groundwater	ug/L			ND	ND	ND	ND
MW-2D	8/83	Weston	2	Groundwater	ug/L			ND	20	ND	1,000
MW-3S	8/83	Weston	2	Groundwater	ug/L			ND	35	ND	65
MW-3D	8/83	Weston	2	Groundwater	ug/L			ND	ND	ND	670
MW-4S	8/83	Weston	2	Groundwater	ug/L			ND	ND	ND	ND
MW-4D	8/83	Weston	2	Groundwater	ug/L			20	13,960	30	220
MW-5S	8/83	Weston	2	Groundwater	ug/L			ND	ND	ND	190
MW-5D	8/83	Weston	2	Groundwater	ug/L			ND	ND	ND	50
HA3597	1/91	Weston	9	West Lagoon	ug/L		<2.8				
HA3598	1/91	Weston	9	East Lagoon	ug/L		<14				
SSW-1	1/91	Weston	9	Surface Water	ug/L		<14	<8.0	<9.5		<22
SSW-2	1/91	Weston	9	Surface Water	ug/L		<2.8	<1.6	<1.9		9.7
SSW-3	1/91	Weston	9	Surface Water	ug/L		<14	<8.0	<9.5		<22
SSW-4	1/91	Weston	9	Surface Water	ug/L		<14	21	<9.5		39.8
SSW-5	1/91	Weston	9	Surface Water	ug/L		<2.8	1.7	<1.9		7.9
MW-1L	1/91	Weston	9	Groundwater	ug/L	<10	<2.8	<1.6	<1.9		<4.4
MW-2L	1/91	Weston	9	Groundwater	ug/L	<250	81.4	<40	<48		190
MW-3L	1/91	Weston	9	Groundwater	ug/L	<10	<2.8	<1.6	<1.9		<4.4
MW-4L	1/91	Weston	9	Groundwater	ug/L	<1,000	415	<160	<190		519
MW-4L	1992	Weston	15	Groundwater	ug/L	<250	180	<250	60 J		250 J
MW-5L	1/91	Weston	9	Groundwater	ug/L	<250	<70	<40	<48		<110
MW-5L	1992	Weston	15	Groundwater	ug/L	<50	56 B	<50	<50		23 J
MW-6L	1/91	Weston	9	Groundwater	ug/L	<100	38.8	<16	<19		534
MW-7L	1/91	Weston	9	Groundwater	ug/L	<250	79.8	<40	<48		501
MW-8L	1/91	Weston	9	Groundwater	ug/L	669	223	244	5,270		388
MW-8L	1992	Weston	15	Groundwater	ug/L	350 J	420 J	190 J	5,600		430 J
MW-9L	1/91	Weston	9	Groundwater	ug/L	<20	<5.6	<3.2	<3.8		31.1
MW-9L	1992	Weston	15	Groundwater	ug/L	<50	32 J	82 J	<50		85 J
MW-10L	1/91	Weston	9	Groundwater	ug/L	<100	28	<16	<19		108

TABLE 116 - 06
SUMMARY OF GROUNDWATER AND SURFACE WATER CHARACTERIZATION
PREVIOUS INVESTIGATIONS
VOLATILE ORGANIC COMPOUNDS/SEMI-VOLATILE ORGANIC COMPOUNDS
SITE 116 - STANDARD CHLORINE CHEMICAL COMPANY

Sample ID	Date Collected	Collected By	Document* Reference	Sample Type	Units	Vinyl Chloride	Methylene Chloride	trans - 1,2-Dichloroethene	Trichloro-ethene	1,1,2-Trichloro-ethane	Benzene
MW-10L	1992	Weston	15	Groundwater	ug/L	<25	28	<25	<25		160
MW-11L	1/91	Weston	9	Groundwater	ug/L	<200	73.3	<32	173		467
MW-11U	1/91	Weston	9	Groundwater	ug/L	<200	<56	174	96		353
MW-12L	1/91	Weston	9	Groundwater	ug/L	<250	<70	<40	108		337
MW-12L	1992	Weston	15	Groundwater	ug/L	<100	46 JB	<100	62 J		260
MW-12U	1/91	Weston	9	Groundwater	ug/L	<200	101	<100	<100		<100
MW-13L	1/91	Weston	9	Groundwater	ug/L	<200	<56	<32	79		118
MW-13U	1/91	Weston	9	Groundwater	ug/L	<10	<2.8	<1.6	<1.9		<4.4
MW-14L	1/91	Weston	9	Groundwater	ug/L	<10	<2.8	<1.6	121		131
MW-14L	1992	Weston	15	Groundwater	ug/L	<20	27 B	<20	71		140
MW-14U	1/91	Weston	9	Groundwater	ug/L	<10	<2.8	<1.6	<1.9		4.6
MW-15L	1/91	Weston	9	Groundwater	ug/L	<1,000	<280	<160	<190		3,010
MW-15U	1/91	Weston	9	Groundwater	ug/L	<10	<2.8	<1.6	<1.9		<4.4
MW-16L	1992	Weston	15	Groundwater	ug/L						
MW-17L	1992	Weston	15	Groundwater	ug/L						
SW-1	8/96	ERM	14	Surface Water	ug/L	<5	<5	<5	<5	<5	<5
SW-2	8/96	ERM	14	Surface Water	ug/L	<5	<5	<5	<5	<5	<5
SW-3	8/96	ERM	14	Surface Water	ug/L	<5	<5	<5	<5	<5	<5
SW-4	8/96	ERM	14	Surface Water	ug/L	<5	<5	<5	<5	<5	<5
116-SW-1	5/00	B&C	19	Surface Water	ug/L	<5	<5	<5	<5	<5	13
116-SW-2	5/00	B&C	19	Surface Water	ug/L	<5	<5	<5	<5	<5	1 J
Higher of PQL and NJDEP Groundwater Quality Criteria					ug/L	5	2	100	1	3	1
Surface Water Quality Criteria for SE2 Streams					ug/L	525	1,600	NA	81	NA	71

SW and SSW - Surface Water Sample ND - Not Detected
MW - Groundwater Sample L and D - Deep Well
*-Refer to List of Documents (Table 116-01)
U and S - Shallow Well NA - Not Available
-Concentration exceeds Higher of NJGWQS and PQL
-Concentration exceeds NJSWQS for SE2 Streams
J- Estimated concentration less than detection limit
B - Analyte detected in laboratory blank.
D - Sample concentration determined by analysis of diluted sample
Weston - Roy F. Weston, Inc.
B&C - Brown and Caldwell

TABLE 116 - 06
SUMMARY OF GROUNDWATER AND SURFACE WATER CHARACTERIZATION
PREVIOUS INVESTIGATIONS
VOLATILE ORGANIC COMPOUNDS/SEMI-VOLATILE ORGANIC COMPOUNDS
SITE 116 - STANDARD CHLORINE CHEMICAL COMPANY

Sample ID	Date Collected	Collected By	Document* Reference	Sample Type	Units	Tetrachloro-ethene	Toluene	Chlorobenzene	Ethylbenzene	Dichlorodi-fluoromethane
MW-1S	8/83	Weston	2	Groundwater	ug/L	ND	ND	ND	ND	
MW-1D	8/83	Weston	2	Groundwater	ug/L	ND	ND	1,850	ND	
MW-2S	8/83	Weston	2	Groundwater	ug/L	ND	ND	1,500	ND	
MW-2D	8/83	Weston	2	Groundwater	ug/L	ND	435	660	300	
MW-3S	8/83	Weston	2	Groundwater	ug/L	25	ND	55	ND	
MW-3D	8/83	Weston	2	Groundwater	ug/L	ND	640	ND	310	
MW-4S	8/83	Weston	2	Groundwater	ug/L	ND	ND	93,000	ND	
MW-4D	8/83	Weston	2	Groundwater	ug/L	5,350	ND	13,900	ND	
MW-5S	8/83	Weston	2	Groundwater	ug/L	ND	ND	450	ND	
MW-5D	8/83	Weston	2	Groundwater	ug/L	ND	ND	ND	ND	
HA3597	1/91	Weston	9	West Lagoon	ug/L		<6	<6		
HA3598	1/91	Weston	9	East Lagoon	ug/L		<30	77.6		
SSW-1	1/91	Weston	9	Surface Water	ug/L		<30	414	<36	
SSW-2	1/91	Weston	9	Surface Water	ug/L		6.2	86	<7.2	
SSW-3	1/91	Weston	9	Surface Water	ug/L		<30	332	<30	
SSW-4	1/91	Weston	9	Surface Water	ug/L		<30	329	<36	
SSW-5	1/91	Weston	9	Surface Water	ug/L		<6	128	<7.2	
MW-1L	1/91	Weston	9	Groundwater	ug/L	<4.1	<6	<6	<7.2	<10
MW-2L	1/91	Weston	9	Groundwater	ug/L	<100	<150	882	<180	<250
MW-3L	1/91	Weston	9	Groundwater	ug/L	<4.1	<6	65.1	<7.2	10.6
MW-4L	1/91	Weston	9	Groundwater	ug/L	<410	<600	1,230	<720	<1,000
MW-4L	1992	Weston	15	Groundwater	ug/L	<250	210 J	300	52 J	
MW-5L	1/91	Weston	9	Groundwater	ug/L	<100	<150	414	<180	<250
MW-5L	1992	Weston	15	Groundwater	ug/L	<50	<50	210	<50	
MW-6L	1/91	Weston	9	Groundwater	ug/L	<41	912	<60	309	<100
MW-7L	1/91	Weston	9	Groundwater	ug/L	<100	1,190	<150	243	<250
MW-8L	1/91	Weston	9	Groundwater	ug/L	1,590	<300	3,060	<360	<500
MW-8L	1992	Weston	15	Groundwater	ug/L	2,900	<500	5,200	<500	
MW-9L	1/91	Weston	9	Groundwater	ug/L	<8.2	14.6	<12	<14	<20
MW-9L	1992	Weston	15	Groundwater	ug/L	40 J	<50	<50	<50	
MW-10L	1/91	Weston	9	Groundwater	ug/L	<41	108	111	<72	<100

TABLE 116 - 06
SUMMARY OF GROUNDWATER AND SURFACE WATER CHARACTERIZATION
PREVIOUS INVESTIGATIONS
VOLATILE ORGANIC COMPOUNDS/SEMI-VOLATILE ORGANIC COMPOUNDS
SITE 116 - STANDARD CHLORINE CHEMICAL COMPANY

Sample ID	Date Collected	Collected By	Document* Reference	Sample Type	Units	Tetrachloro-ethene	Toluene	Chlorobenzene	Ethylbenzene	Dichlorodi-fluoromethane
MW-10L	1992	Weston	15	Groundwater	ug/L	<25	150	140	73	
MW-11L	1/91	Weston	9	Groundwater	ug/L	<82	<120	1,110	<140	<200
MW-11U	1/91	Weston	9	Groundwater	ug/L	96.7	<120	796	<140	<200
MW-12L	1/91	Weston	9	Groundwater	ug/L	<100	1,290	743	240	<250
MW-12L	1992	Weston	15	Groundwater	ug/L	16 J	770	400	100	
MW-12U	1/91	Weston	9	Groundwater	ug/L	<100	<100	<100	<100	<200
MW-13L	1/91	Weston	9	Groundwater	ug/L	<82	<120	200	<140	<200
MW-13U	1/91	Weston	9	Groundwater	ug/L	<4.1	<6	<6	<7.2	<10
MW-14L	1/91	Weston	9	Groundwater	ug/L	74.1	115	<6	21.1	<10
MW-14L	1992	Weston	15	Groundwater	ug/L	74	200	48	55	
MW-14U	1/91	Weston	9	Groundwater	ug/L	<4.1	20.7	1,830	51.1	<10
MW-15L	1/91	Weston	9	Groundwater	ug/L	<410	<600	<6	<720	<1,000
MW-15U	1/91	Weston	9	Groundwater	ug/L	<4.1	<6	<6	<7.2	<10
MW-16L	1992	Weston	15	Groundwater	ug/L					
MW-17L	1992	Weston	15	Groundwater	ug/L					
SW-1	8/96	ERM	14	Surface Water	ug/L	<5	<5	<5	<5	<5
SW-2	8/96	ERM	14	Surface Water	ug/L	<5	<5	<5	<5	<5
SW-3	8/96	ERM	14	Surface Water	ug/L	<5	<5	<2.52	<5	<5
SW-4	8/96	ERM	14	Surface Water	ug/L	<5	<5	<5	<5	<5
116-SW-1	5/00	B&C	19	Surface Water	ug/L	<5	<5	130	<5	
116-SW-2	5/00	B&C	19	Surface Water	ug/L	<5	<5	13	<5	
Higher of PQL and NJDEP Groundwater Quality Criteria					ug/L	1	1,000	4	700	NA
Surface Water Quality Criteria for SE2 Streams					ug/L	4.29	200,000	21,000	27,900	NA

SW and SSW - Surface Water Sample
ND - Not Detected
MW - Groundwater Sample
L and D - Deep Well
*-Refer to List of Documents (Table 116-01)
U and S - Shallow Well
NA - Not Available
-Concentration exceeds Higher of NJGWQS and PQL
-Concentration exceeds NJSWQS for SE2 Streams
J- Estimated concentration less than detection limit
B - Analyte detected in laboratory blank.
D - Sample concentration determined by analysis of diluted sample
Weston - Roy F. Weston, Inc.
B&C - Brown and Caldwell

TABLE 116 - 06
SUMMARY OF GROUNDWATER AND SURFACE WATER CHARACTERIZATION
PREVIOUS INVESTIGATIONS
VOLATILE ORGANIC COMPOUNDS/SEMI-VOLATILE ORGANIC COMPOUNDS
SITE 116 - STANDARD CHLORINE CHEMICAL COMPANY

Sample ID	Date Collected	Collected By	Document* Reference	Sample Type	Units	bis (Chloromethyl) ether	1.2-Dichloro- benzene	1,3-Dichloro- benzene	1,4-Dichloro- benzene	Naphthalene
MW-1S	8/83	Weston	2	Groundwater	ug/L		ND	ND	ND	ND
MW-1D	8/83	Weston	2	Groundwater	ug/L		1,500	3,100	4,100	10
MW-2S	8/83	Weston	2	Groundwater	ug/L		ND	ND	ND	ND
MW-2D	8/83	Weston	2	Groundwater	ug/L		2,700	1,400	3,700	ND
MW-3S	8/83	Weston	2	Groundwater	ug/L		ND	ND	ND	ND
MW-3D	8/83	Weston	2	Groundwater	ug/L		ND	ND	ND	53
MW-4S	8/83	Weston	2	Groundwater	ug/L		ND	ND	10	510
MW-4D	8/83	Weston	2	Groundwater	ug/L		4,900	ND	ND	ND
MW-5S	8/83	Weston	2	Groundwater	ug/L		ND	ND	ND	ND
MW-5D	8/83	Weston	2	Groundwater	ug/L		ND	ND	ND	ND
HA3597	1/91	Weston	9	West Lagoon	ug/L		<1.9	4.6	10.5	12.7
HA3598	1/91	Weston	9	East Lagoon	ug/L		2.0	10.2	23	3.1
SSW-1	1/91	Weston	9	Surface Water	ug/L		171	296	369	9.14
SSW-2	1/91	Weston	9	Surface Water	ug/L		224	85.5	192	260
SSW-3	1/91	Weston	9	Surface Water	ug/L		542	432	517	16.4
SSW-4	1/91	Weston	9	Surface Water	ug/L		2,740	2,920	4,680	3.97
SSW-5	1/91	Weston	9	Surface Water	ug/L		321	278	385	7.07
MW-1L	1/91	Weston	9	Groundwater	ug/L	<10	2.58	<2.1	<4.8	<1.7
MW-2L	1/91	Weston	9	Groundwater	ug/L	<250	19,600	18,500	21,900	111
MW-3L	1/91	Weston	9	Groundwater	ug/L	<10	30,300	24,600	29,500	55.8
MW-4L	1/91	Weston	9	Groundwater	ug/L	<1,000	28,100	26,900	29,200	70.8
MW-4L	1992	Weston	15	Groundwater	ug/L		9,600	8,000	11,900	68 J
MW-5L	1/91	Weston	9	Groundwater	ug/L	<250	9,650	6,030	10,400	19.6
MW-5L	1992	Weston	15	Groundwater	ug/L		5,100	3,000	4,900	<62
MW-6L	1/91	Weston	9	Groundwater	ug/L	<100	<10	<10	<24	12,700
MW-7L	1/91	Weston	9	Groundwater	ug/L	<250	1,570	152	279	23,700
MW-8L	1/91	Weston	9	Groundwater	ug/L	<500	13,800	12,500	12,300	4,970
MW-8L	1992	Weston	15	Groundwater	ug/L		16,000	15,000	18,000	<62
MW-9L	1/91	Weston	9	Groundwater	ug/L	<20	<110	<110	<250	58,200
MW-9L	1992	Weston	15	Groundwater	ug/L		<5,600	<5,600	<5,600	<5,600
MW-10L	1/91	Weston	9	Groundwater	ug/L	<100	156	60.4	110	4,990

TABLE 116 - 06
SUMMARY OF GROUNDWATER AND SURFACE WATER CHARACTERIZATION
PREVIOUS INVESTIGATIONS
VOLATILE ORGANIC COMPOUNDS/SEMI-VOLATILE ORGANIC COMPOUNDS
SITE 116 - STANDARD CHLORINE CHEMICAL COMPANY

Sample ID	Date Collected	Collected By	Document* Reference	Sample Type	Units	bis (Chloromethyl) ether	1,2-Dichloro-benzene		1,3-Dichloro-benzene		1,4-Dichloro-benzene		Naphthalene	
MW-10L	1992	Weston	15	Groundwater	ug/L		640		<620		380	J	2,400	
MW-11L	1/91	Weston	9	Groundwater	ug/L	<200	6,650		1,570		2,310		7,150	
MW-11U	1/91	Weston	9	Groundwater	ug/L	<200	5,250		892		1,910		9,660	
MW-12L	1/91	Weston	9	Groundwater	ug/L	<250	5,290		1,130		2,560		11,700	
MW-12L	1992	Weston	15	Groundwater	ug/L		12,900		2,800		5,400		19,000	
MW-12U	1/91	Weston	9	Groundwater	ug/L	<200	145		65.9		141		426	
MW-13L	1/91	Weston	9	Groundwater	ug/L	<200	771		239		497		16,400	
MW-13U	1/91	Weston	9	Groundwater	ug/L	<10	74.2		25.4		51.7		5,020	
MW-14L	1/91	Weston	9	Groundwater	ug/L	<10	2,780		2,650		4,610		5,020	
MW-14L	1992	Weston	15	Groundwater	ug/L		2,100		1,900		2,700		6,400	J
MW-14U	1/91	Weston	9	Groundwater	ug/L	<10	5.2		4.1		9.56		6,540	
MW-15L	1/91	Weston	9	Groundwater	ug/L	<1,000	20,600		15,200		19,500		20.4	
MW-15U	1/91	Weston	9	Groundwater	ug/L	<10	140		78.6		109		<1.8	
MW-16L	1992	Weston	15	Groundwater	ug/L		330		460		540		6	J
MW-17L	1992	Weston	15	Groundwater	ug/L		7,400	D	12,000	D	11,000	D	12	
SW-1	8/96	ERM	14	Surface Water	ug/L		1.6		<5		<1.47		<5	
SW-2	8/96	ERM	14	Surface Water	ug/L		1.4		<5		<1.21		<5	
SW-3	8/96	ERM	14	Surface Water	ug/L		6		<4.56		6.4		<5	
SW-4	8/96	ERM	14	Surface Water	ug/L		3.1		<5		<1.8		<5	
116-SW-1	5/00	B&C	19	Surface Water	ug/L	<10	57		58		28		<10	
116-SW-2	5/00	B&C	19	Surface Water	ug/L	<12	13		11		17		<12	
Higher of PQL and NJDEP Groundwater Quality Criteria					ug/L	NA	600		600		75		NA	
Surface Water Quality Criteria for SE2 Streams					ug/L	NA	16,500		22,200		3,159		NA	

SW and SSW - Surface Water Sample
ND - Not Detected
MW - Groundwater Sample
L and D - Deep Well
*-Refer to List of Documents (Table 116-01)
U and S - Shallow Well
NA - Not Available
-Concentration exceeds Higher of NJGWQS and PQL
-Concentration exceeds NJSWQS for SE2 Streams
J- Estimated concentration less than detection limit
B - Analyte detected in laboratory blank.
D - Sample concentration determined by analysis of diluted sample
Weston - Roy F. Weston, Inc.
B&C - Brown and Caldwell

TABLE 116 - 07
SUMMARY OF GROUNDWATER AND SURFACE WATER CHARACTERIZATION
PREVIOUS INVESTIGATIONS
DIOXIN
SITE 116 - STANDARD CHLORINE CHEMICAL COMPANY

Sample ID	Date Collected	Collected By	Document* Reference	Sample Type	Units	Dioxin
MW-11L	1/91	Weston	9	Groundwater	ug/L	<0.0048
MW-11U	1/91	Weston	9	Groundwater	ug/L	<0.0011
MW-12L	1/91	Weston	9	Groundwater	ug/L	<0.0079
MW-12U	1/91	Weston	9	Groundwater	ug/L	<0.0009
MW-13L	1/91	Weston	9	Groundwater	ug/L	<0.0435
MW-13U	1/91	Weston	9	Groundwater	ug/L	<0.0002
MW-14L	1/91	Weston	9	Groundwater	ug/L	<0.0016
MW-14U	1/91	Weston	9	Groundwater	ug/L	<0.002
West Lagoon	1/91	Weston	9	Groundwater	ug/L	<0.0012
East Lagoon	1/91	Weston	9	Groundwater	ug/L	<0.0039
NJDEP Groundwater Quality Criteria					ug/L	0.01

L - Deep Well
U - Shallow Well
*-Refer to List of Documents (Table 116-01)
Weston - Roy F. Weston, Inc.

TABLE 116 - 08
SUMMARY OF DNAPL THICKNESSES
SITE 116 - STANDARD CHLORINE CHEMICAL COMPANY

Well Number	Date	Approximate DNAPL Thickness (ft)
MW-4L	7/15/1996	0.25
PZ-4D	7/15/1996	1.2
MW-8L	9/19/1995	2.51
	9/25/1995	2.89
	7/15/1996	2.26
MW-12L	9/19/1995	0.01
	9/25/1995	1.1
	7/15/1996	1.34
MW-13L	9/19/1995	0.05
	9/25/1995	1.52
	7/15/1996	1.91
MW-14L	9/19/1995	0.73
	9/25/1995	0.79
	7/15/1996	0.9

Measurements collected on 9/19/95 by Oil/Water Interface Probe.
Measurements collected on 9/25/95 by Conductivity Probe.
Measurements collected by Environmental Resource Management
L and D - Lower Water-Bearing Zone Wells

TABLE 116-09
SUMMARY OF DNAPL CHARACTERIZATION
SITE 116 - STANDARD CHLORINE CHEMICAL COMPANY

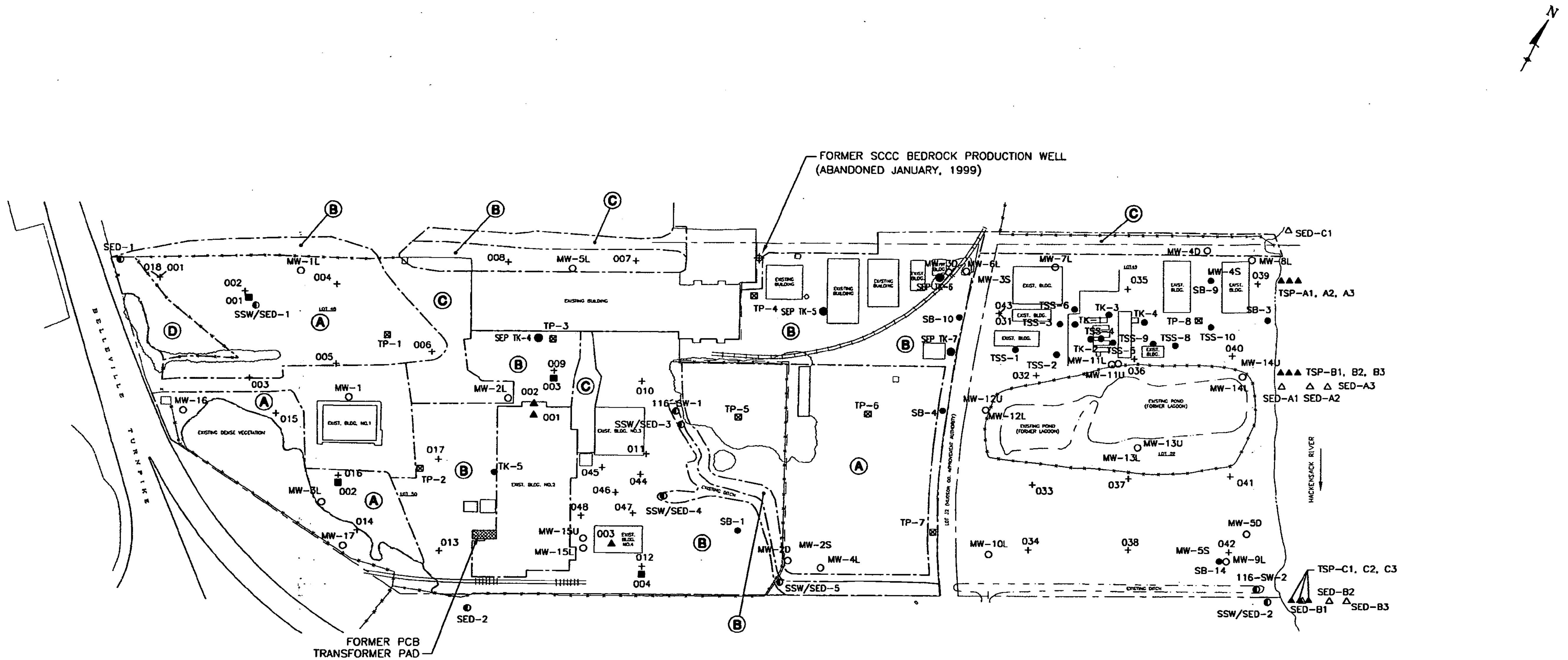
Sample ID	Date Collected	Collected By	Document Reference*	Units	Chlorobenzene		1,2-Dichlorobenzene	1,3-Dichlorobenzene		1,4-Dichlorobenzene	
MW-8L	9/19/1995	ERM	14	ug/L	9,000		160,000	74,000	J	68,000	J
MW-12L	9/19/1995	ERM	14	ug/L	1,700	J	99,000	40,000	J	49,000	
MW-13L	9/19/1995	ERM	14	ug/L	<2,500		12,000	3,600	J	6,500	
MW-14L	9/19/1995	ERM	14	ug/L	<2,500		45,000	41,000		54,000	J

Notes
MW- Groundwater Sample
*-Refer to List of Documents (Table 116-01)
L - Deep Well
J- Estimated concentration
NA - Not Analyzed
ERM - Environmental Resource Management, Inc.

TABLE 116-09
SUMMARY OF DNAPL CHARACTERIZATION
SITE 116 - STANDARD CHLORINE CHEMICAL COMPANY

Sample ID	Date Collected	Collected By	Document Reference*	Units	Naphthalene		1,2,4-Trichlorobenzene	Viscosity (SSU)	Specific Gravity
MW-8L	9/19/1995	ERM	14	ug/L	41,000	J	620,000	30	1.38
MW-12L	9/19/1995	ERM	14	ug/L	200,000		160,000	NA	NA
MW-13L	9/19/1995	ERM	14	ug/L	150,000		99,000	37	1.34
MW-14L	9/19/1995	ERM	14	ug/L	75,000		770,000	NA	NA

Notes
MW- Groundwater Sample
*-Refer to List of Documents (Table 116-01)
L - Deep Well
J- Estimated concentration
NA - Not Analyzed
ERM - Environmental Resource Management, Inc.



LEGEND

001	SURFACE SOIL SAMPLE LOCATION AND NUMBER (NUMBER PREFIXED BY 116-SS-)
001	SWEEP SAMPLE LOCATION AND NUMBER (NUMBER PREFIXED BY 116-SW-)
001	BULK SAMPLE LOCATION AND NUMBER (NUMBER PREFIXED BY 116-BK-)
SEP TK-4	SEPTIC TANK LOCATION
MW-1	PREVIOUSLY INSTALLED MONITORING WELLS
TP-1	TEST PIT
SSW/SED	SURFACE WATER/SEDIMENT SAMPLE
TSP-A1	SEDIMENT SAMPLE LOCATION
	PROPERTY LINE
	RIGHT OF WAY LINE
	FENCE LINE
	EXISTING STRUCTURE
	IRM BOUNDARY
IRM (A)	4" OF 3/4"-1 1/2" STONE OVER GEOTEXTILE FABRIC/GEOMEMBRANE LINER COMPOSITE
IRM (B)	4" ASPHALT PAVEMENT OVER 4" COMPACTED DENSE GRADED AGGREGATE OVER GEOTEXTILE FABRIC
IRM (C)	ASPHALT PAVEMENT OVERLAY (THICKNESS VARIES)
IRM (D)	6" OF 1 1/2" TO 3" STONE OVER GEOTEXTILE FABRIC/GEOMEMBRANE LINER OVER WELL GRADED STABILIZATION STONE

NOTE: THIS FIGURE IS AN INTEGRAL PART OF THE RI WORK PLAN PREPARED IN RESPONSE TO THE APRIL 17,1990 ACO.

SOURCE:
PREVIOUS SAMPLE LOCATIONS AND FEATURES OBTAINED FROM VARIOUS SOURCES (REFER TO TABLE 116-01). BROWN & CALDWELL ASSUMES NO RESPONSIBILITY FOR ACCURACY OF SAME.

80 0 80 160
scale feet

NO.	REVISIONS	REV'D BY	DATE	APPRO'D BY

BROWN AND CALDWELL
MAHWAH, NEW JERSEY

STANDARD CHLORINE
SITE NO. 116
KEARNY, NEW JERSEY

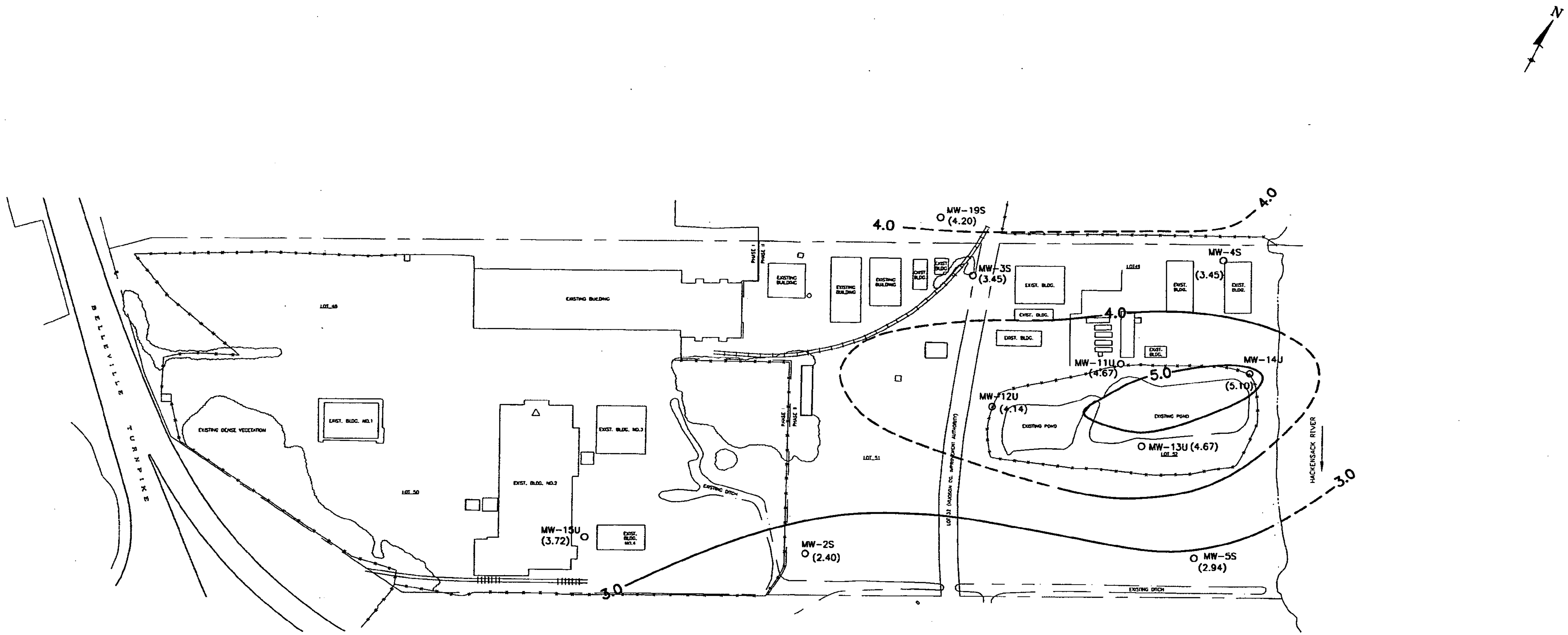
LOCATION OF SITE FEATURES AND PREVIOUS SAMPLE LOCATIONS

SCALE: AS SHOWN			
DRAWN BY: PL	DATE: 06/01	CHECKED BY: JCS	APPROVED BY: WGS

SUBREGION I

FIGURE 116-2.1

R116-27 07/12/01 PLOT 1=50 (R116-27.PCP)



LEGEND

MW-1 O	PREVIOUSLY INSTALLED MONITORING WELLS
(2.40)	GROUNDWATER ELEVATION (FT., MSL)
—4.0—	GROUNDWATER ELEVATION CONTOUR (FT., MSL) (DASHED WHERE INFERRED) CONTOUR INTERVAL: 1.0 FOOT
	PROPERTY LINE
	RIGHT OF WAY LINE
	FENCE LINE
	EXISTING STRUCTURE
S-	UPPER WATER-BEARING ZONE WELL
U-	UPPER WATER-BEARING ZONE WELL

80 0 80 160
scale feet

NOTES:
DATA ARE FROM WORK DONE BY ROY F. WESTON, INC. IN DECEMBER 1990 AND JANUARY 1991.
TAKEN FROM TABLE 3-4 OF SUPPLEMENTAL REMEDIAL INVESTIGATION REPORT. (KEY ENVIRONMENTAL, INC., APRIL 1999).
WATER LEVEL DATA COLLECTED 2/2/99 BY KEY ENVIRONMENTAL, INC.

B116-26 06/25/01 PLOT 1=80 (B1116-25.PCP)

BROWN AND CALDWELL
MAHWAH, NEW JERSEY

NO.	REVISIONS	REV'D BY	DATE	APPRO'D BY

STANDARD CHLORINE
SITE NO. 116
KEARNY, NEW JERSEY

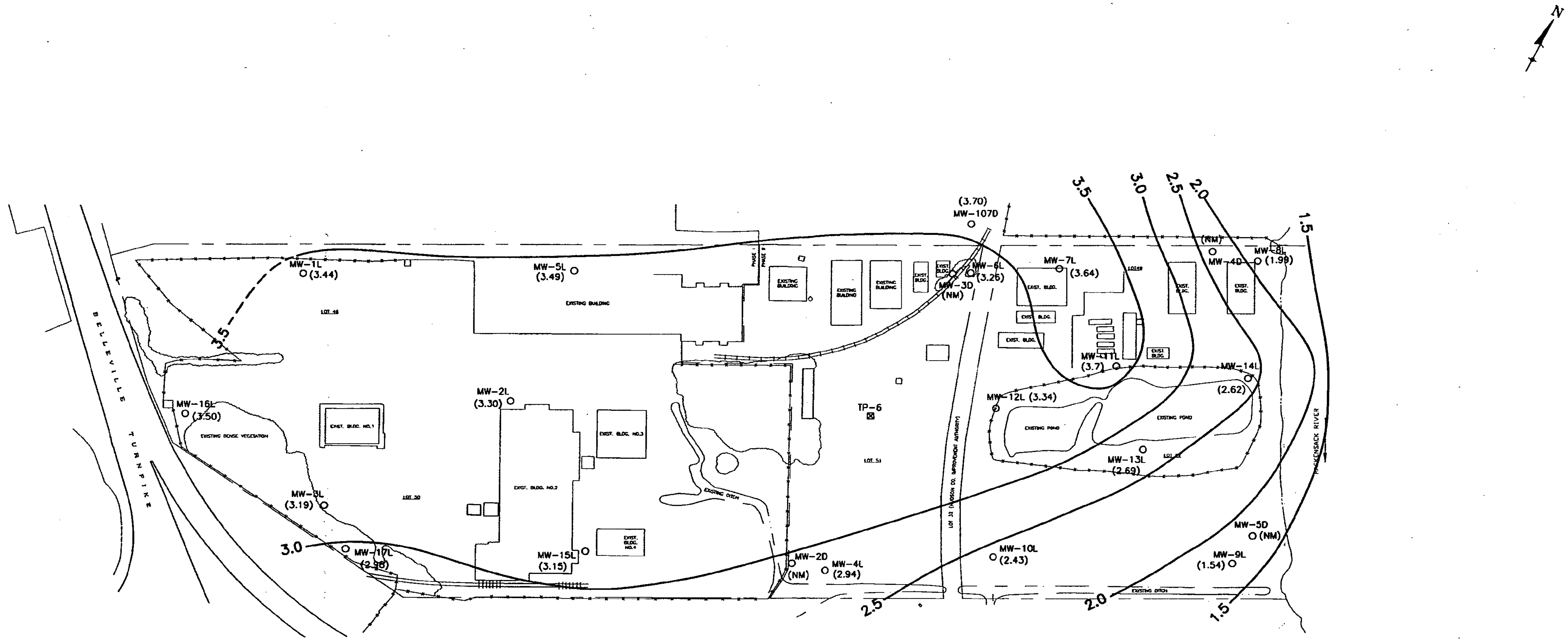
GROUNDWATER ELEVATION CONTOURS
UPPER WATER BEARING ZONE

SCALE: AS SHOWN

DRAWN BY	DATE	CHECKED BY	APPROVED BY
PL	06/01	JCS	WGS

SUBREGION I

FIGURE 116-2.2



LEGEND

MW-1 ○ PREVIOUSLY INSTALLED MONITORING WELLS

(2.43) GROUNDWATER ELEVATION (FT., MSL)

—2.5— GROUNDWATER ELEVATION CONTOUR (FT., MSL) (DASHED WHERE INFERRED) CONTOUR INTERVAL: 0.5 FEET

PROPERTY LINE

RIGHT OF WAY LINE

FENCE LINE

EXISTING STRUCTURE

D- LOWER WATER-BEARING ZONE WELL

L- LOWER WATER-BEARING ZONE WELL

NM- NOT MEASURED

NOTES:

DATA ARE FROM WORK DONE BY ROY F. WESTON, INC. IN DECEMBER 1990 AND JANUARY 1991.

TAKEN FROM TABLE 3-4 OF SUPPLEMENTAL REMEDIAL INVESTIGATION REPORT. (KEY ENVIRONMENTAL, INC., APRIL 1999).

WATER LEVEL DATA COLLECTED 2/2/99 BY KEY ENVIROMENTAL.

80 0 80 160
scale feet

NO.	REVISIONS	REV'D BY	DATE	APPRO'D BY

BROWN AND CALDWELL
MAHWAH, NEW JERSEY

STANDARD CHLORINE
SITE NO. 116
KEARNY, NEW JERSEY

GROUNDWATER ELEVATION CONTOURS
LOWER WATER-BEARING ZONE

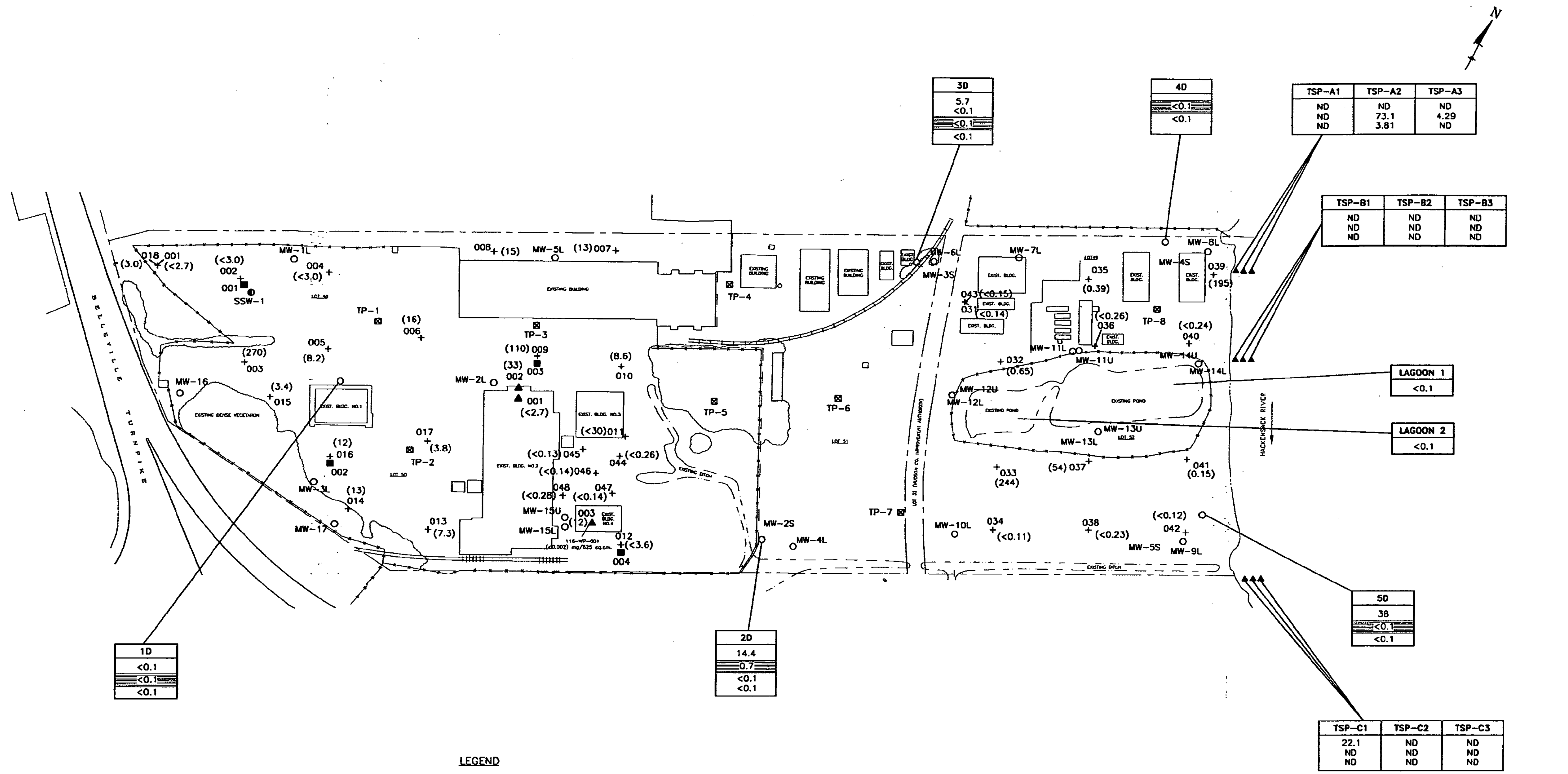
SCALE: AS SHOWN

DRAWN BY	DATE	CHECKED BY	APPROVED BY
PL	06/01	JCS	WGS

SUBREGION I

FIGURE 116-2.3

R1116-23 06/28/01 PLOT 1=80 (R1116-23.PCP)



LEGEND

001	SURFACE SOIL SAMPLE LOCATION AND NUMBER (NUMBER PREFIXED BY 116-SS-)
001	SWEEP SAMPLE LOCATION AND NUMBER (NUMBER PREFIXED BY 116-SW-)
001	BULK SAMPLE LOCATION AND NUMBER (NUMBER PREFIXED BY 116-BK-)
(<0.28)	Cr^{+6} CONCENTRATION (mg/Kg)
MW-1	PREVIOUSLY INSTALLED MONITORING WELLS
TP-1	TEST PIT
TSP-A1	SEDIMENT SAMPLE LOCATION
ND-	NOT DETECTED

2D	SAMPLE LOCATION NUMBER
14.4 / 0.7	Cr^{+6} CONCENTRATION (mg/Kg)
	RELATIVE POSITION OF MEADOW MAT
	PROPERTY LINE
	RIGHT OF WAY LINE
	FENCE LINE
	EXISTING STRUCTURE

NOTES: THIS FIGURE IS AN INTEGRAL PART OF THE RI WORK PLAN PREPARED IN RESPONSE TO THE APRIL 17,1990 ACO.
REFER TO TABLES 116-01 AND 116-02 FOR IDENTIFICATION OF DATA SOURCES AND SAMPLE DEPTHS.

80 0 80 160
scale feet

NO.	REVISIONS	REV'D BY	DATE	APPRO'D BY

BROWN AND CALDWELL
MAHWAH, NEW JERSEY

STANDARD CHLORINE
SITE NO. 116
KEARNY, NEW JERSEY

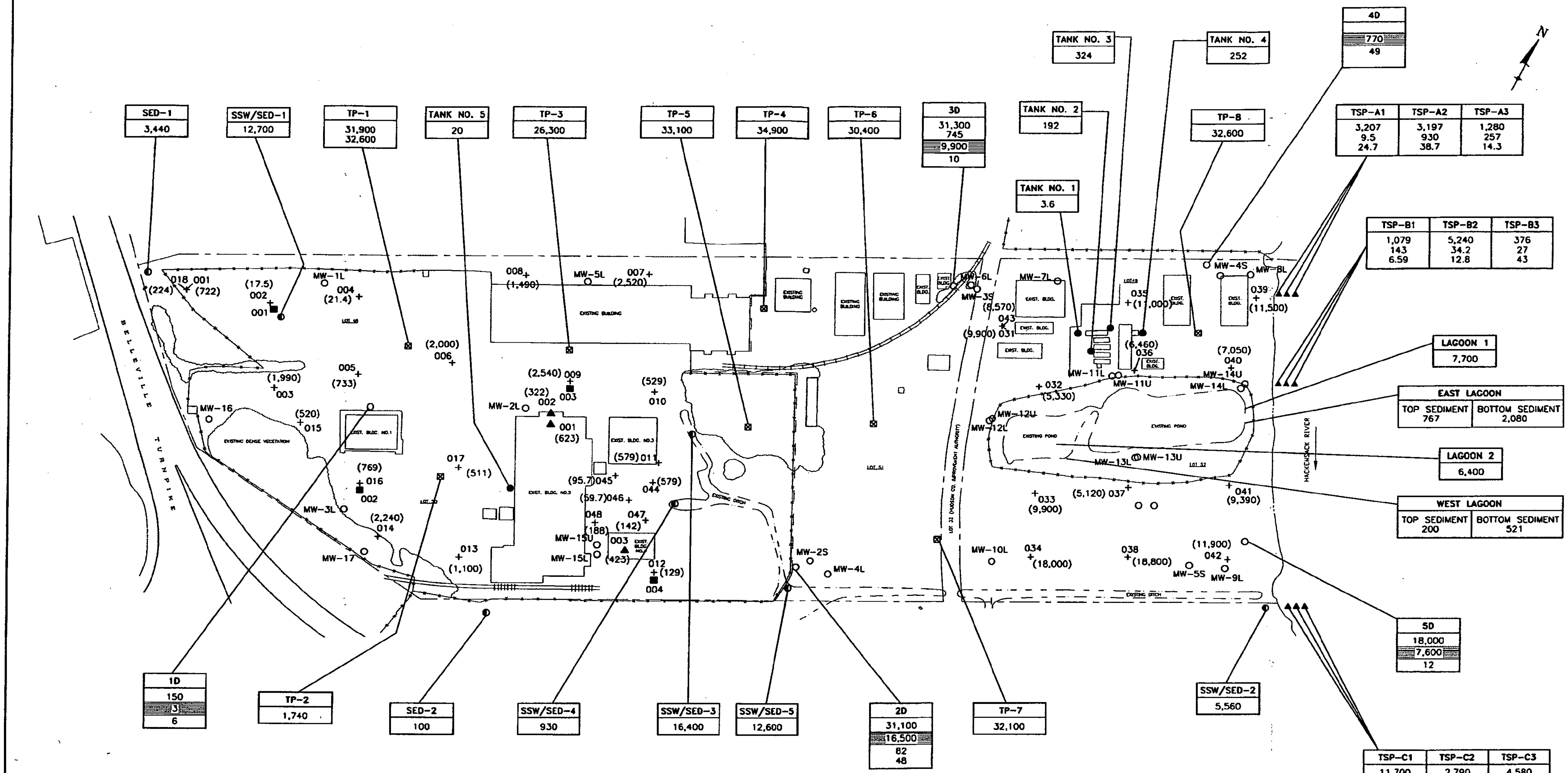
HEXAVALENT CHROMIUM CONCENTRATIONS IN SOIL AND SEDIMENT (mg/Kg)

SCALE: AS SHOWN

DRAWN BY	DATE	CHECKED BY	APPROVED BY
JHM	6/01	JCS	WGS

SUBREGION I
FIGURE 116-2.4

R116-10 07/12/01 PLOT 1=80 (R116-01.PCP)



LEGEND

001	SURFACE SOIL SAMPLE LOCATION AND NUMBER (NUMBER PREFIXED BY 116-SS-)
001	SWEEP SAMPLE LOCATION AND NUMBER (NUMBER PREFIXED BY 116-SW-)
001	BULK SAMPLE LOCATION AND NUMBER (NUMBER PREFIXED BY 116-BK-)
(2,000)	TOTAL Cr CONCENTRATION (mg/Kg)
MW-1	PREVIOUSLY INSTALLED MONITORING WELLS
TP-1	TEST PIT
SSW/SED	SEDIMENT SAMPLE
TANK NO. 1	TANK
TSP-A1	SEDIMENT SAMPLE LOCATION

3D — SAMPLE LOCATION NUMBER
31,300 745 — TOTAL Cr CONCENTRATION (mg/Kg)
RELATIVE POSITION OF MEADOW MAT
PROPERTY LINE
RIGHT OF WAY LINE
FENCE LINE
EXISTING STRUCTURE

80 0 80 160
scale feet

NOTES: THIS FIGURE IS AN INTEGRAL PART OF THE RI WORK PLAN PREPARED IN RESPONSE TO THE APRIL 17,1990 ACO.
REFER TO TABLES 116-01 AND 116-02 FOR IDENTIFICATION OF DATA SOURCES AND SAMPLE DEPTHS.

BROWN AND CALDWELL
MAHWAH, NEW JERSEY

STANDARD CHLORINE
SITE NO. 116
KEARNY, NEW JERSEY

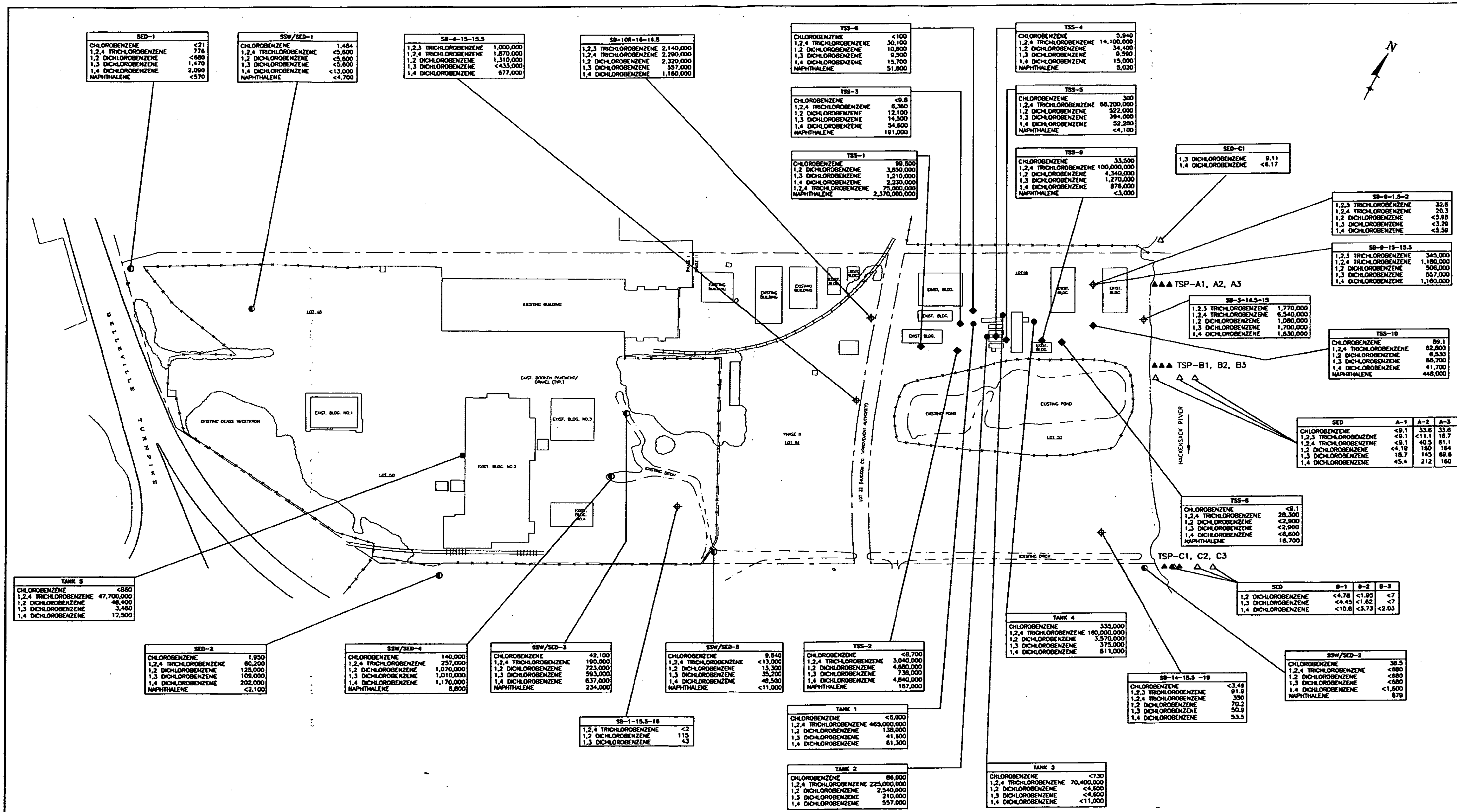
TOTAL CHROMIUM CONCENTRATIONS IN SOIL AND SEDIMENT (mg/Kg)

SCALE: AS SHOWN
DRAWN BY JHM DATE 6/01 CHECKED BY JCS APPROVED BY WGS

SUBREGION I FIGURE 116-2.5

NO. REVISIONS REV'D BY DATE APPRO'D BY

R116-09 07/11/01 PLOT 1=80 (R116-01.PCP)



SED-1	
CHLOROBENZENE	<21
1,2,4 TRICHLOROBENZENE	776
1,2 DICHLOROBENZENE	<680
1,3 DICHLOROBENZENE	1,470
1,4 DICHLOROBENZENE	2,090
NAPHTHALENE	<570

SSW/SED-1	
CHLOROBENZENE	1,484
1,2,4 TRICHLOROBENZENE	<5,600
1,2 DICHLOROBENZENE	<5,600
1,3 DICHLOROBENZENE	<5,600
1,4 DICHLOROBENZENE	<13,000
NAPHTHALENE	<4,700

SB-4-15-15.5	
1,2,3 TRICHLOROBENZENE	1,000,000
1,2,4 TRICHLOROBENZENE	1,870,000
1,2 DICHLOROBENZENE	1,310,000
1,3 DICHLOROBENZENE	<433,000
1,4 DICHLOROBENZENE	677,000

SB-10R-16-16.5	
1,2,3 TRICHLOROBENZENE	2,140,000
1,2,4 TRICHLOROBENZENE	2,290,000
1,2 DICHLOROBENZENE	2,320,000
1,3 DICHLOROBENZENE	557,000
1,4 DICHLOROBENZENE	1,160,000

TSS-6	
CHLOROBENZENE	<100
1,2,4 TRICHLOROBENZENE	30,100
1,2 DICHLOROBENZENE	10,800
1,3 DICHLOROBENZENE	9,500
1,4 DICHLOROBENZENE	15,700
NAPHTHALENE	51,800

TSS-3	
CHLOROBENZENE	<9.8
1,2,4 TRICHLOROBENZENE	6,360
1,2 DICHLOROBENZENE	12,100
1,3 DICHLOROBENZENE	14,500
1,4 DICHLOROBENZENE	34,800
NAPHTHALENE	191,000

TSS-1	
CHLOROBENZENE	99,600
1,2 DICHLOROBENZENE	3,850,000
1,3 DICHLOROBENZENE	1,210,000
1,4 DICHLOROBENZENE	2,230,000
1,2,4 TRICHLOROBENZENE	75,000,000
NAPHTHALENE	2,370,000,000

TSS-4	
CHLOROBENZENE	3,940
1,2,4 TRICHLOROBENZENE	14,100,000
1,2 DICHLOROBENZENE	34,400
1,3 DICHLOROBENZENE	9,590
1,4 DICHLOROBENZENE	15,000
NAPHTHALENE	5,020

TSS-5	
CHLOROBENZENE	300
1,2,4 TRICHLOROBENZENE	68,200,000
1,2 DICHLOROBENZENE	322,000
1,3 DICHLOROBENZENE	394,000
1,4 DICHLOROBENZENE	52,200
NAPHTHALENE	<4,100

TSS-9	
CHLOROBENZENE	33,500
1,2,4 TRICHLOROBENZENE	100,000,000
1,2 DICHLOROBENZENE	4,340,000
1,3 DICHLOROBENZENE	1,270,000
1,4 DICHLOROBENZENE	876,000
NAPHTHALENE	<3,000

SED-C1	
1,3 DICHLOROBENZENE	9.11
1,4 DICHLOROBENZENE	<6.17

SB-9-1.5-2	
1,2,3 TRICHLOROBENZENE	32.6
1,2,4 TRICHLOROBENZENE	20.3
1,2 DICHLOROBENZENE	<5.98
1,3 DICHLOROBENZENE	<3.29
1,4 DICHLOROBENZENE	<5.59

SB-9-15-15.5	
1,2,3 TRICHLOROBENZENE	345,000
1,2,4 TRICHLOROBENZENE	1,180,000
1,2 DICHLOROBENZENE	506,000
1,3 DICHLOROBENZENE	557,000
1,4 DICHLOROBENZENE	1,160,000

SB-3-14.5-15	
1,2,3 TRICHLOROBENZENE	1,770,000
1,2,4 TRICHLOROBENZENE	6,540,000
1,2 DICHLOROBENZENE	1,080,000
1,3 DICHLOROBENZENE	1,700,000
1,4 DICHLOROBENZENE	1,630,000

TSS-10	
CHLOROBENZENE	89.1
1,2,4 TRICHLOROBENZENE	62,800
1,2 DICHLOROBENZENE	6,530
1,3 DICHLOROBENZENE	66,200
1,4 DICHLOROBENZENE	41,700
NAPHTHALENE	448,000

SED	A-1	A-2	A-3
CHLOROBENZENE	<9.1	33.6	33.6
1,2,3 TRICHLOROBENZENE	<9.1	<11.1	18.7
1,2,4 TRICHLOROBENZENE	<9.1	40.5	61.1
1,2 DICHLOROBENZENE	<4.19	160	164
1,3 DICHLOROBENZENE	18.7	145	69.6
1,4 DICHLOROBENZENE	45.4	212	160

TSS-8	
CHLOROBENZENE	<9.1
1,2,4 TRICHLOROBENZENE	28,300
1,2 DICHLOROBENZENE	<2,900
1,3 DICHLOROBENZENE	<2,900
1,4 DICHLOROBENZENE	<8,600
NAPHTHALENE	16,700

SED	B-1	B-2	B-3
1,2 DICHLOROBENZENE	<4.78	<1.95	<7
1,3 DICHLOROBENZENE	<4.45	<1.62	<7
1,4 DICHLOROBENZENE	<10.8	<3.73	<2.03

TANK 5	
CHLOROBENZENE	<860
1,2,4 TRICHLOROBENZENE	47,700,000
1,2 DICHLOROBENZENE	48,400
1,3 DICHLOROBENZENE	3,480
1,4 DICHLOROBENZENE	12,500

SED-2	
CHLOROBENZENE	1,950
1,2,4 TRICHLOROBENZENE	60,200
1,2 DICHLOROBENZENE	125,000
1,3 DICHLOROBENZENE	109,000
1,4 DICHLOROBENZENE	202,000
NAPHTHALENE	<2,100

SSW/SED-4	
CHLOROBENZENE	140,000
1,2,4 TRICHLOROBENZENE	257,000
1,2 DICHLOROBENZENE	1,070,000
1,3 DICHLOROBENZENE	1,010,000
1,4 DICHLOROBENZENE	1,170,000
NAPHTHALENE	8,800

SSW/SED-3	
CHLOROBENZENE	42,100
1,2,4 TRICHLOROBENZENE	190,000
1,2 DICHLOROBENZENE	723,000
1,3 DICHLOROBENZENE	593,000
1,4 DICHLOROBENZENE	637,000
NAPHTHALENE	234,000

SSW/SED-8	
CHLOROBENZENE	9,640
1,2,4 TRICHLOROBENZENE	<13,000
1,2 DICHLOROBENZENE	13,300
1,3 DICHLOROBENZENE	35,200
1,4 DICHLOROBENZENE	48,500
NAPHTHALENE	<11,000

SB-1-15.5-16	
1,2,4 TRICHLOROBENZENE	<2
1,2 DICHLOROBENZENE	115
1,3 DICHLOROBENZENE	43

TSS-2	
CHLOROBENZENE	<8,700
1,2,4 TRICHLOROBENZENE	3,040,000
1,2 DICHLOROBENZENE	4,680,000
1,3 DICHLOROBENZENE	738,000
1,4 DICHLOROBENZENE	4,840,000
NAPHTHALENE	167,000

TANK 1	
CHLOROBENZENE	<6,000
1,2,4 TRICHLOROBENZENE	465,000,000
1,2 DICHLOROBENZENE	138,000
1,3 DICHLOROBENZENE	41,600
1,4 DICHLOROBENZENE	61,300

TANK 2	
CHLOROBENZENE	86,000
1,2,4 TRICHLOROBENZENE	225,000,000
1,2 DICHLOROBENZENE	2,540,000
1,3 DICHLOROBENZENE	210,000
1,4 DICHLOROBENZENE	557,000

TANK 4	
CHLOROBENZENE	335,000
1,2,4 TRICHLOROBENZENE	160,000,000
1,2 DICHLOROBENZENE	3,570,000
1,3 DICHLOROBENZENE	375,000
1,4 DICHLOROBENZENE	811,000

TANK 3	
CHLOROBENZENE	<730
1,2,4 TRICHLOROBENZENE	70,400,000
1,2 DICHLOROBENZENE	<4,600
1,3 DICHLOROBENZENE	<4,600
1,4 DICHLOROBENZENE	<11,000

SB-14-18.5 -19	
CHLOROBENZENE	<3.49
1,2,3 TRICHLOROBENZENE	91.9
1,2,4 TRICHLOROBENZENE	350
1,2 DICHLOROBENZENE	70.2
1,3 DICHLOROBENZENE	50.9
1,4 DICHLOROBENZENE	53.5

SSW/SED-2	
CHLOROBENZENE	38.5
1,2,4 TRICHLOROBENZENE	<680
1,2 DICHLOROBENZENE	<680
1,3 DICHLOROBENZENE	<680
1,4 DICHLOROBENZENE	<1,600
NAPHTHALENE	879

NOTES: THIS FIGURE IS AN INTEGRAL PART OF THE RI WORK PLAN PREPARED IN RESPONSE TO THE APRIL 17,1990 ACO.
REFER TO TABLE 116-01 AND 116-04 FOR IDENTIFICATION OF DATA SOURCES AND SAMPLE DEPTHS.

LEGEND

SSW/SED ◐ SEDIMENT SAMPLE
SB-1 ⌖ SOIL BORING
TSS-1 ◆ TANK SOIL SAMPLE
TSP-1 ▲ SEDIMENT SAMPLE COLLECTED JANUARY 2000 REFER TO DOCUMENT NO.21 FOR DATA.

SB-1-15.5-16	
1,2,4 TRICHLOROBENZENE	<2
1,2 DICHLOROBENZENE	115
1,3 DICHLOROBENZENE	43

SAMPLE LOCATION NUMBER
COMPOUND AND CONCENTRATION (μg/Kg)

PROPERTY LINE
RIGHT OF WAY LINE
FENCE LINE
EXISTING STRUCTURE

80 0 80 160
scale feet

NO.	REVISIONS	REV'D BY	DATE	APPRO'D BY

BROWN AND CALDWELL
MAHWAH, NEW JERSEY

SCALE: AS SHOWN

DRAWN BY	DATE	CHECKED BY	APPROVED BY
JHM	06/01	JCS	WOS

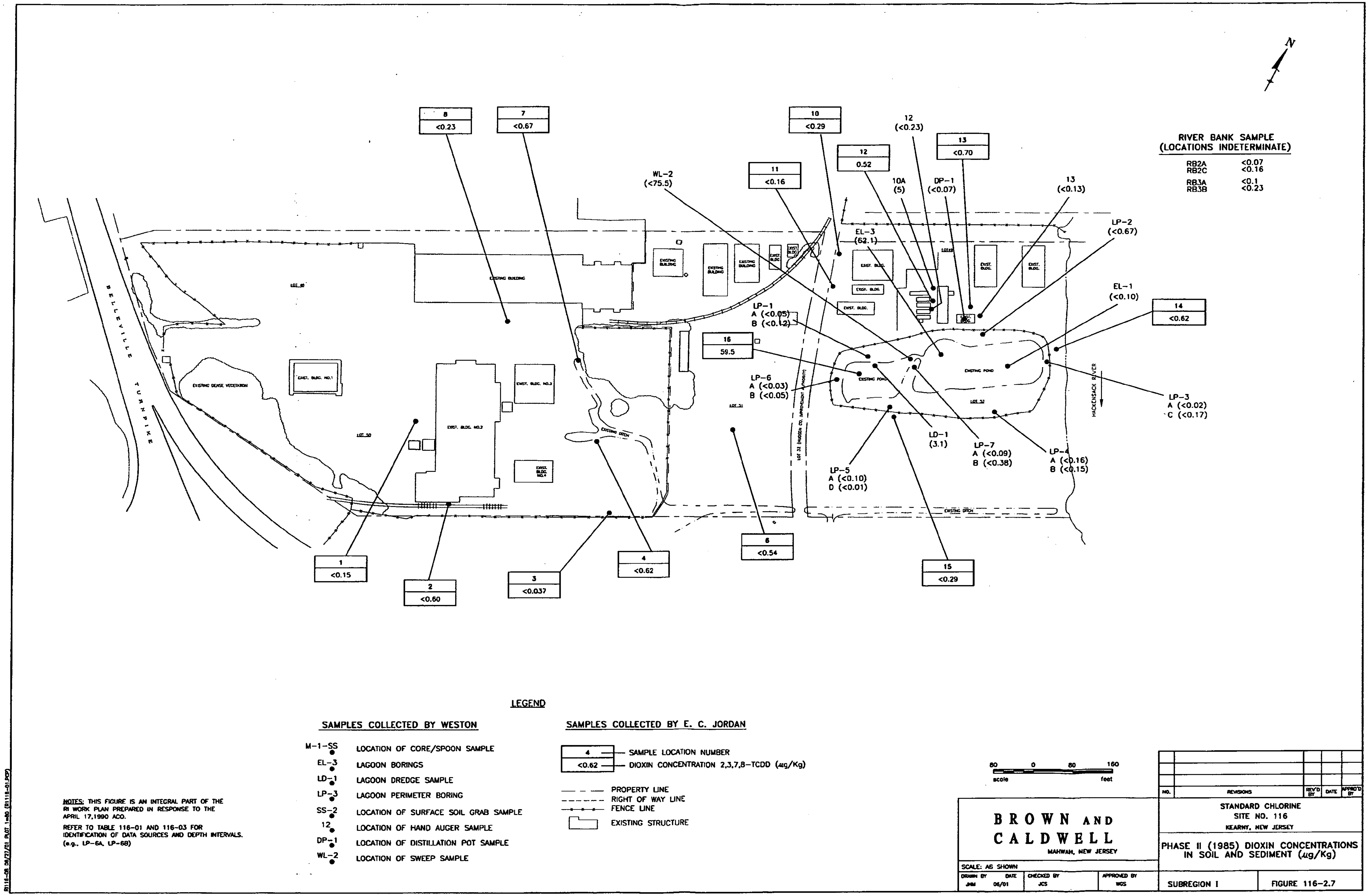
STANDARD CHLORINE
SITE NO. 116
KEARNY, NEW JERSEY

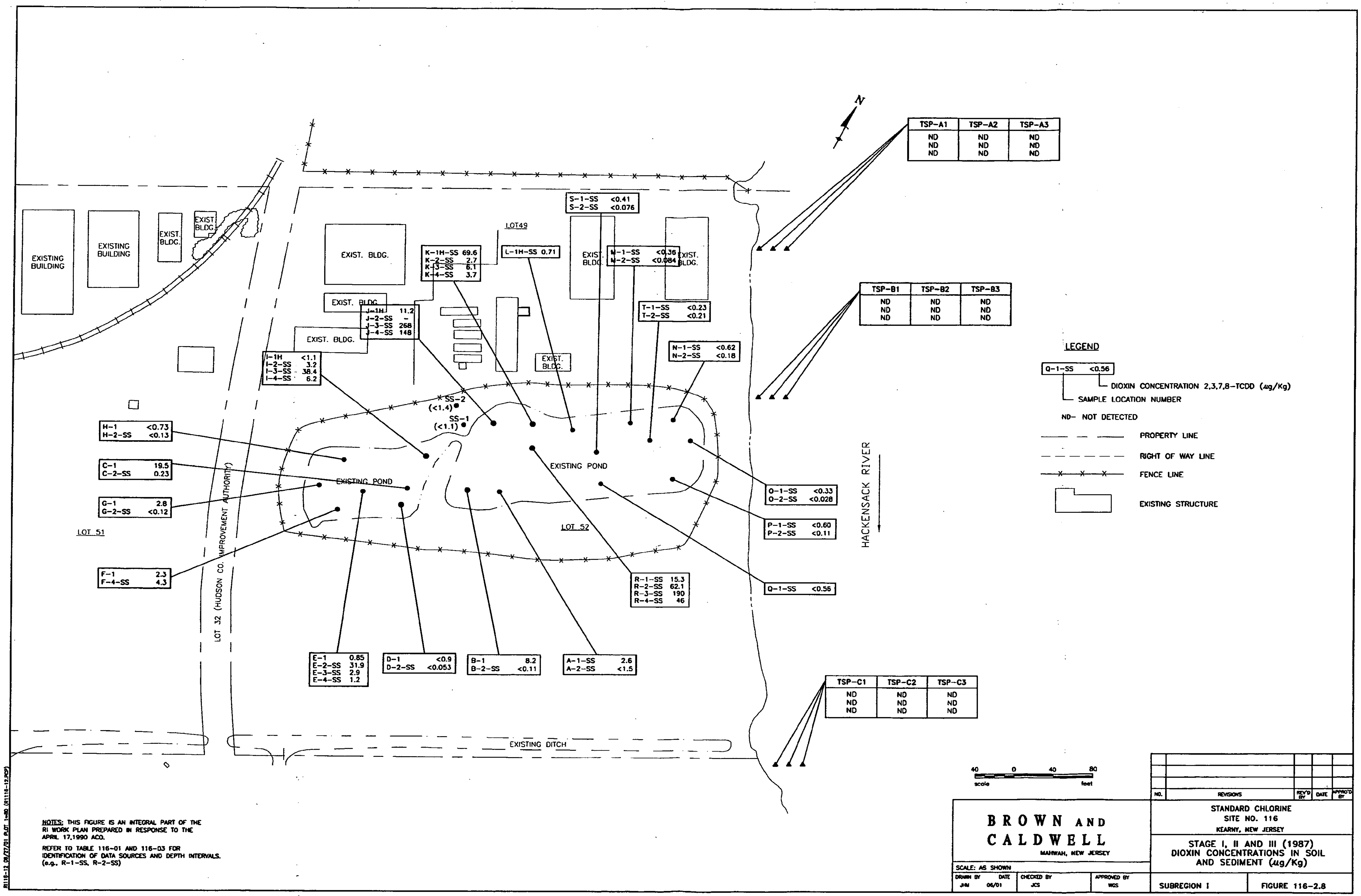
CHLOROBENZENES AND NAPHTHALENE IN SOIL AND SEDIMENT (μg/kg)

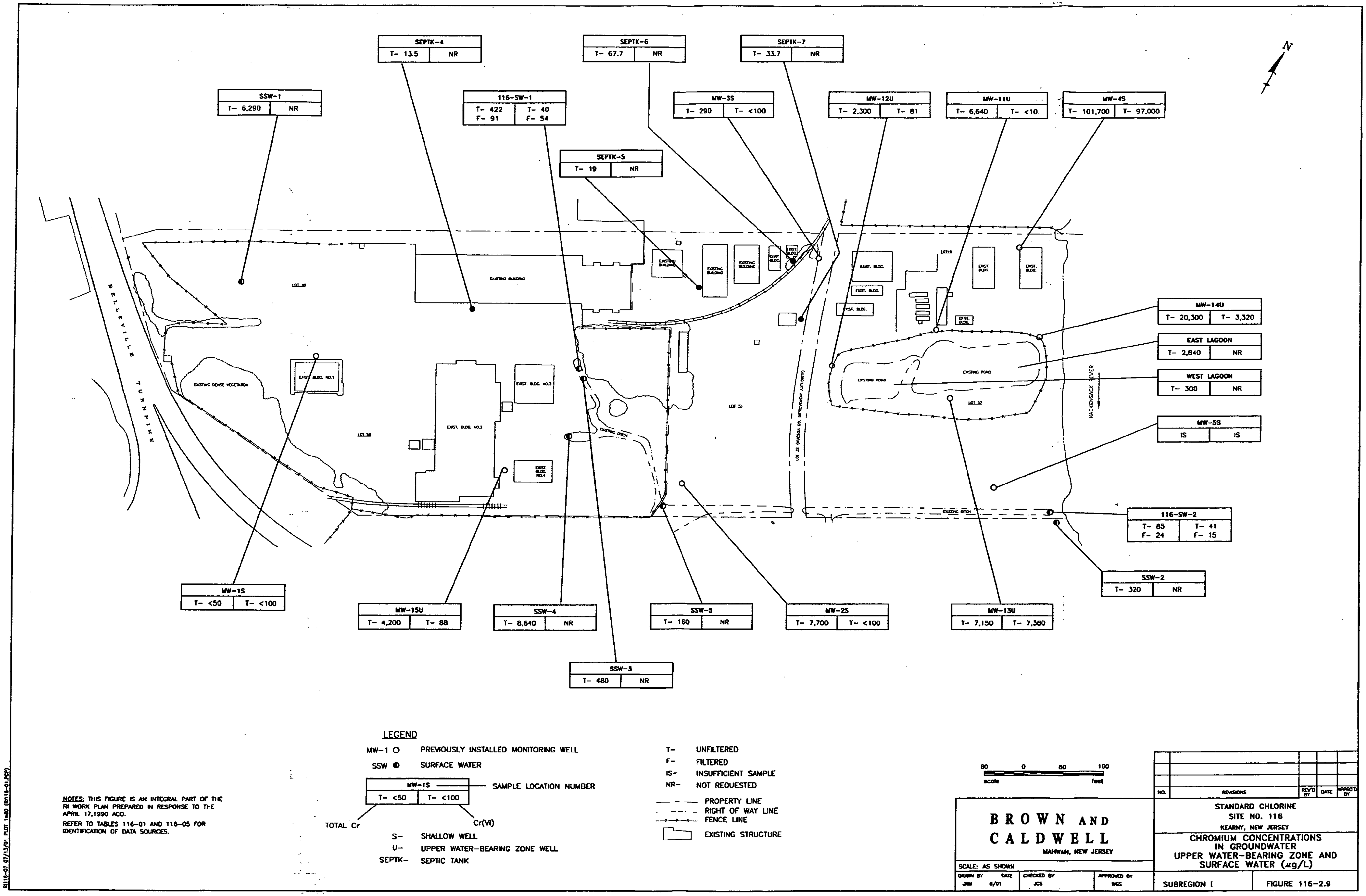
SUBREGION I

FIGURE 116-2.6

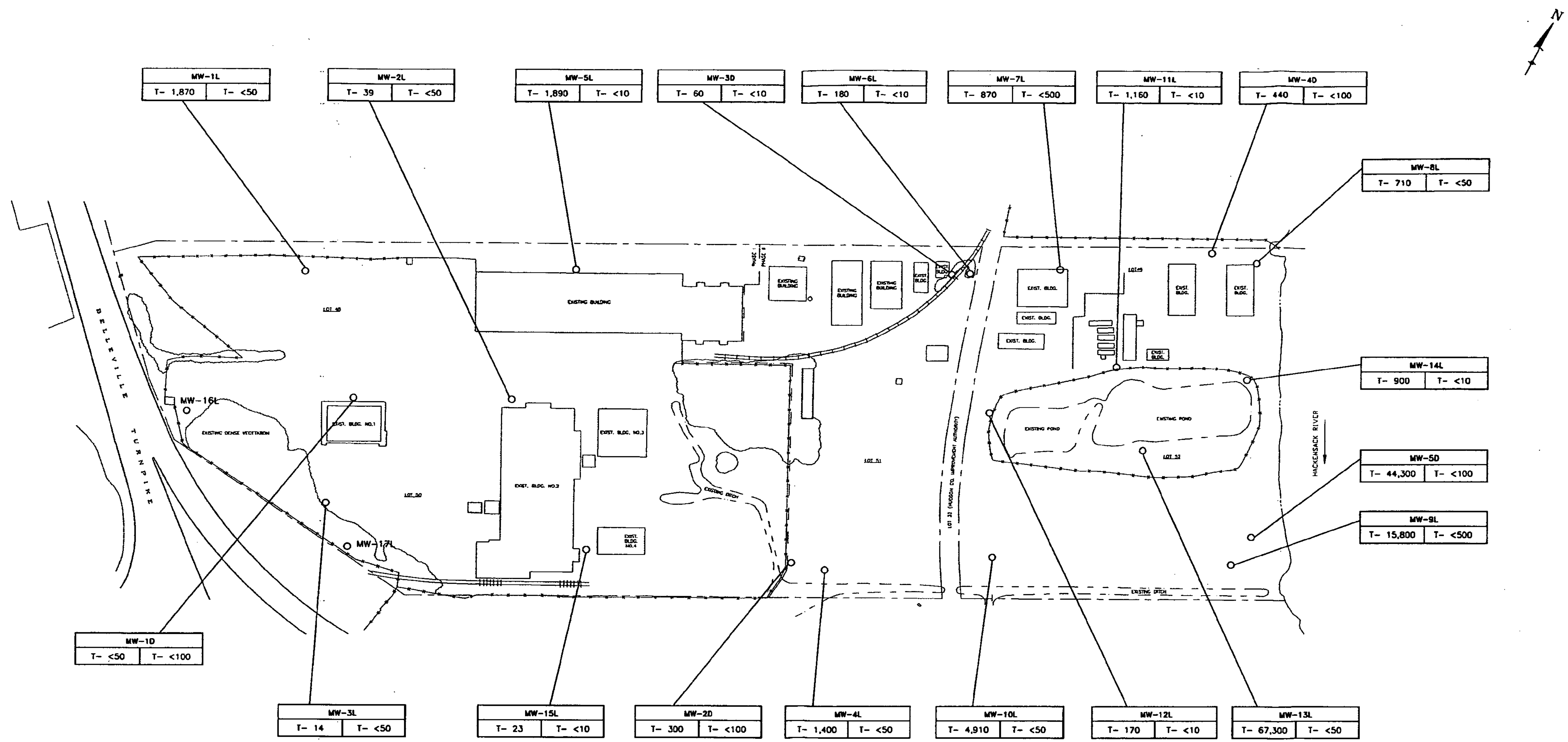
R116-24 06/28/01 PLOT 1=80 (R1116-01.PCP)


N
RIVER BANK SAMPLE
(LOCATIONS INDETERMINATE)
RB2A <0.07
RB2C <0.16
RB3A <0.1
RB3B <0.23
8 <0.23
7 <0.67
10 <0.29
11 <0.16
12 0.52
13 <0.70
12 (<0.23)
10A (5)
DP-1 (<0.07)
13 (<0.13)
WL-2 (<75.5)
EL-3 (62.1)
LP-2 (<0.67)
EL-1 (<0.10)
14 <0.62
LP-1 A (<0.05) B (<0.12)
16 59.5
LP-6 A (<0.03) B (<0.05)
LP-3 A (<0.02) C (<0.17)
LD-1 (3.1)
LP-7 A (<0.09) B (<0.38)
LP-4 A (<0.16) B (<0.15)
LP-5 A (<0.10) D (<0.01)
1 <0.15
2 <0.60
3 <0.037
4 <0.62
6 <0.54
15 <0.29
BELLEVILLE TURNPIKE
HACKENSACK RIVER
EXISTING BUILDING
EXISTING DENSE VEGETATION
EXIST. BLDG. NO.1
EXIST. BLDG. NO.2
EXIST. BLDG. NO.3
EXIST. BLDG. NO.4
EXISTING POND
EXISTING DITCH
LOT 50
LOT 51
LOT 52
LEGEND
SAMPLES COLLECTED BY WESTON
M-1-SS LOCATION OF CORE/SPOON SAMPLE
EL-3 LAGOON BORINGS
LD-1 LAGOON DREDGE SAMPLE
LP-3 LAGOON PERIMETER BORING
SS-2 LOCATION OF SURFACE SOIL GRAB SAMPLE
12 LOCATION OF HAND AUGER SAMPLE
DP-1 LOCATION OF DISTILLATION POT SAMPLE
WL-2 LOCATION OF SWEEP SAMPLE
SAMPLES COLLECTED BY E. C. JORDAN
4 SAMPLE LOCATION NUMBER
<0.62 DIOXIN CONCENTRATION 2,3,7,8-TCDD (µg/Kg)
PROPERTY LINE
RIGHT OF WAY LINE
FENCE LINE
EXISTING STRUCTURE
NOTES: THIS FIGURE IS AN INTEGRAL PART OF THE RI WORK PLAN PREPARED IN RESPONSE TO THE APRIL 17,1990 ACO.
REFER TO TABLE 116-01 AND 116-03 FOR IDENTIFICATION OF DATA SOURCES AND DEPTH INTERVALS. (e.g., LP-6A, LP-6B)
80 0 80 160
scale feet
BROWN AND CALDWELL
MAHWAH, NEW JERSEY
SCALE: AS SHOWN
DRAWN BY JHM DATE 06/01 CHECKED BY JCS APPROVED BY WGS
NO. REVISIONS REV'D BY DATE APPRO'D BY
STANDARD CHLORINE
SITE NO. 116
KEARNY, NEW JERSEY
PHASE II (1985) DIOXIN CONCENTRATIONS IN SOIL AND SEDIMENT (µg/Kg)
SUBREGION I
FIGURE 116-2.7


TSP-A1 TSP-A2 TSP-A3
ND ND ND
ND ND ND
ND ND ND
TSP-B1 TSP-B2 TSP-B3
ND ND ND
ND ND ND
ND ND ND
TSP-C1 TSP-C2 TSP-C3
ND ND ND
ND ND ND
ND ND ND
EXISTING BUILDING
EXISTING BUILDING
EXIST. BLDG.
EXIST. BLDG.
EXIST. BLDG.
EXIST. BLDG.
EXIST. BLDG.
EXIST. BLDG.
EXIST. BLDG.
EXIST. BLDG.
EXIST. BLDG.
LOT49
LOT 51
LOT 52
LOT 32 (HUDSON CO. IMPROVEMENT AUTHORITY)
EXISTING POND
EXISTING POND
EXISTING DITCH
HACKENSACK RIVER
N
S-1-SS <0.41
S-2-SS <0.076
K-1H-SS 69.6
K-2-SS 2.7
K-3-SS 6.1
K-4-SS 3.7
L-1H-SS 0.71
M-1-SS <0.36
M-2-SS <0.084
T-1-SS <0.23
T-2-SS <0.21
J-1H 11.2
J-2-SS -
J-3-SS 268
J-4-SS 148
N-1-SS <0.62
N-2-SS <0.18
I-1H <1.1
I-2-SS 3.2
I-3-SS 38.4
I-4-SS 6.2
SS-2 (<1.4)
SS-1 (<1.1)
H-1 <0.73
H-2-SS <0.13
C-1 19.5
C-2-SS 0.23
G-1 2.8
G-2-SS <0.12
F-1 2.3
F-4-SS 4.3
O-1-SS <0.33
O-2-SS <0.028
P-1-SS <0.60
P-2-SS <0.11
Q-1-SS <0.56
R-1-SS 15.3
R-2-SS 62.1
R-3-SS 190
R-4-SS 46
E-1 0.85
E-2-SS 31.9
E-3-SS 2.9
E-4-SS 1.2
D-1 <0.9
D-2-SS <0.053
B-1 8.2
B-2-SS <0.11
A-1-SS 2.6
A-2-SS <1.5
LEGEND
Q-1-SS <0.56
DIOXIN CONCENTRATION 2,3,7,8-TCDD (µg/Kg)
SAMPLE LOCATION NUMBER
ND- NOT DETECTED
PROPERTY LINE
RIGHT OF WAY LINE
FENCE LINE
EXISTING STRUCTURE
40 0 40 80
scale feet
NOTES: THIS FIGURE IS AN INTEGRAL PART OF THE RI WORK PLAN PREPARED IN RESPONSE TO THE APRIL 17,1990 ACO.
REFER TO TABLE 116-01 AND 116-03 FOR IDENTIFICATION OF DATA SOURCES AND DEPTH INTERVALS. (e.g., R-1-SS, R-2-SS)
NO. REVISIONS REV'D BY DATE APPRO'D BY
BROWN AND CALDWELL
MAHWAH, NEW JERSEY
SCALE: AS SHOWN
DRAWN BY JHM DATE 06/01 CHECKED BY JCS APPROVED BY WGS
STANDARD CHLORINE
SITE NO. 116
KEARNY, NEW JERSEY
STAGE I, II AND III (1987)
DIOXIN CONCENTRATIONS IN SOIL AND SEDIMENT (µg/Kg)
SUBREGION I
FIGURE 116-2.8



SEPTK-4
T- 13.5 NR
SEPTK-6
T- 67.7 NR
SEPTK-7
T- 33.7 NR
SSW-1
T- 6,290 NR
116-SW-1
T- 422 F- 91
T- 40 F- 54
MW-3S
T- 290 T- <100
MW-12U
T- 2,300 T- 81
MW-11U
T- 6,640 T- <10
MW-4S
T- 101,700 T- 97,000
SEPTK-5
T- 19 NR
MW-14U
T- 20,300 T- 3,320
EAST LAGOON
T- 2,840 NR
WEST LAGOON
T- 300 NR
MW-5S
IS IS
116-SW-2
T- 85 F- 24
T- 41 F- 15
SSW-2
T- 320 NR
MW-1S
T- <50 T- <100
MW-15U
T- 4,200 T- 88
SSW-4
T- 8,640 NR
SSW-5
T- 160 NR
MW-2S
T- 7,700 T- <100
MW-13U
T- 7,150 T- 7,380
SSW-3
T- 480 NR
BELLEVILLE TURNPIKE
HACKENSACK RIVER
N
EXISTING BUILDING
EXISTING DENSE VEGETATION
EXIST. BLDG. NO.1
EXIST. BLDG. NO.2
EXIST. BLDG. NO.3
EXIST. BLDG. NO.4
EXISTING DITCH
EXISTING POND
LOT 50
LOT 51
LOT 52
LEGEND
MW-1 PREVIOUSLY INSTALLED MONITORING WELL
SSW SURFACE WATER
MW-1S
T- <50 T- <100
SAMPLE LOCATION NUMBER
TOTAL Cr
Cr(VI)
S- SHALLOW WELL
U- UPPER WATER-BEARING ZONE WELL
SEPTK- SEPTIC TANK
T- UNFILTERED
F- FILTERED
IS- INSUFFICIENT SAMPLE
NR- NOT REQUESTED
PROPERTY LINE
RIGHT OF WAY LINE
FENCE LINE
EXISTING STRUCTURE
80 0 80 160
scale feet
NOTES: THIS FIGURE IS AN INTEGRAL PART OF THE RI WORK PLAN PREPARED IN RESPONSE TO THE APRIL 17,1990 ACO.
REFER TO TABLES 116-01 AND 116-05 FOR IDENTIFICATION OF DATA SOURCES.
NO. REVISIONS REV'D BY DATE APPRO'D BY
BROWN AND CALDWELL
MAHWAH, NEW JERSEY
SCALE: AS SHOWN
DRAWN BY JHM DATE 6/01 CHECKED BY JCS APPROVED BY WGS
STANDARD CHLORINE
SITE NO. 116
KEARNY, NEW JERSEY
CHROMIUM CONCENTRATIONS IN GROUNDWATER UPPER WATER-BEARING ZONE AND SURFACE WATER (µg/L)
SUBREGION I
FIGURE 116-2.9



LEGEND

MW-1 O PREVIOUSLY INSTALLED MONITORING WELL

MW-1D	
T- <50	T- <100

SAMPLE LOCATION NUMBER

TOTAL Cr — Cr(VI)

T- UNFILTERED
L- LOWER WATER-BEARING ZONE WELL
D- LOWER WATER-BEARING ZONE WELL

PROPERTY LINE
RIGHT OF WAY LINE
FENCE LINE
EXISTING STRUCTURE

NOTES: THIS FIGURE IS AN INTEGRAL PART OF THE RI WORK PLAN PREPARED IN RESPONSE TO THE APRIL 17,1990 ACO.

REFER TO TABLES 116-01 AND 116-05 FOR IDENTIFICATION OF DATA SOURCES.

80 0 80 160
scale feet

NO.	REVISIONS	REV'D BY	DATE	APPRO'D BY

BROWN AND CALDWELL
MAHWAH, NEW JERSEY

STANDARD CHLORINE
SITE NO. 116
KEARNY, NEW JERSEY

CHROMIUM CONCENTRATIONS IN GROUNDWATER LOWER WATER-BEARING ZONE ($\mu g/L$)

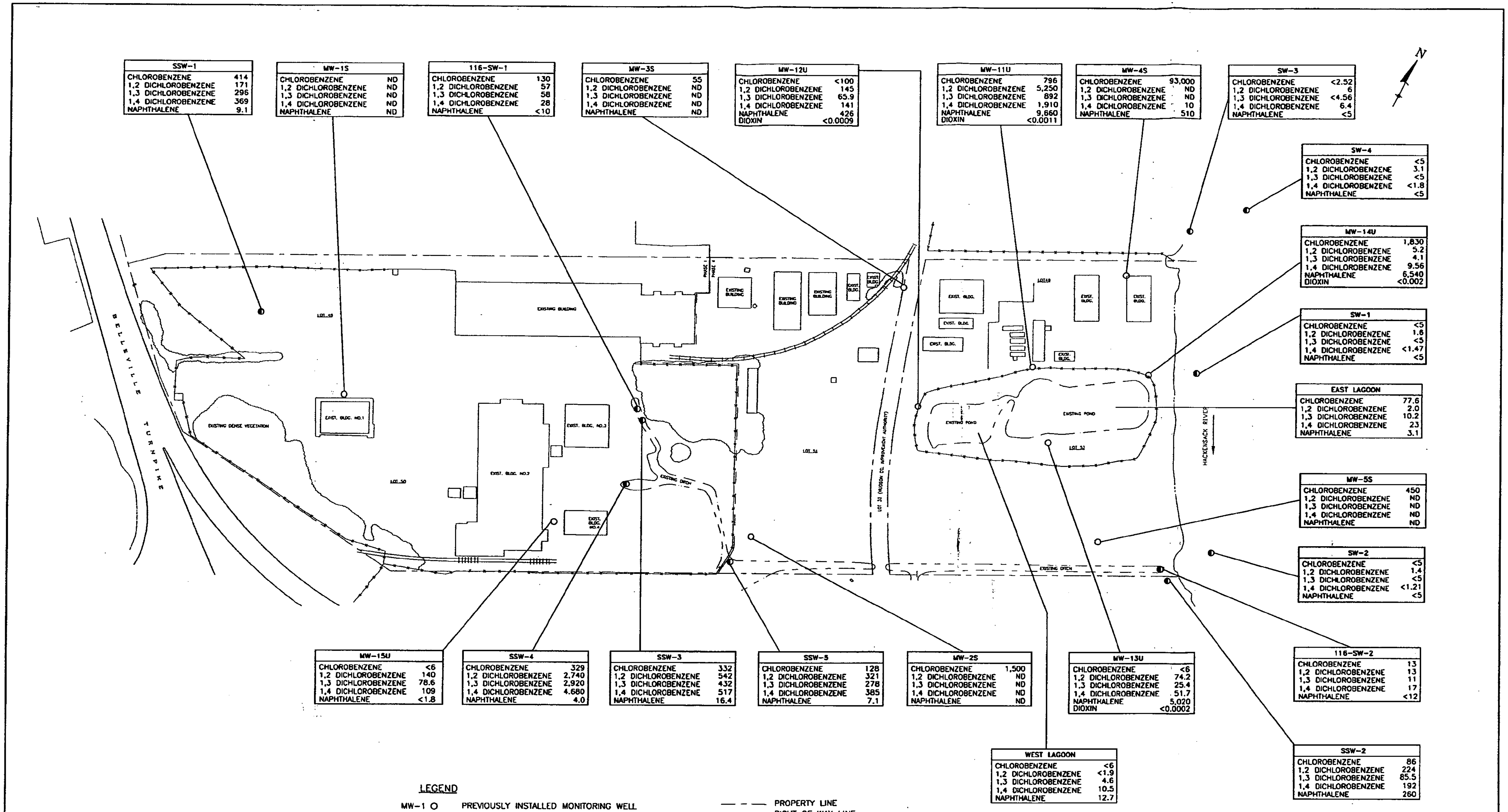
SCALE: AS SHOWN

DRAWN BY	DATE	CHECKED BY	APPROVED BY
JHM	6/01	JCS	WGS

SUBREGION I

FIGURE 116-2.10

R116-06 07/11/01 PLOT 1=80 (R116-01.PCP)



LEGEND

MW-1 ○ PREVIOUSLY INSTALLED MONITORING WELL

SSW ◐ SURFACE WATER SAMPLE

SSW-1 — SAMPLE LOCATION NUMBER

SSW-1	
CHLOROBENZENE	414
1,2 DICHLOROBENZENE	171
1,3 DICHLOROBENZENE	296
1,4 DICHLOROBENZENE	369
NAPHTHALENE	9.14

CONCENTRATION (μg/L)

NOTE: DIOXIN CONCENTRATIONS REFER TO 2,3,7,8-TCDD.

S- UPPER WATER-BEARING ZONE WELL

U- UPPER WATER-BEARING ZONE WELL

ND- NOT DETECTED

PROPERTY LINE

RIGHT OF WAY LINE

FENCE LINE

EXISTING STRUCTURE

NOTES: THIS FIGURE IS AN INTEGRAL PART OF THE RI WORK PLAN PREPARED IN RESPONSE TO THE APRIL 17,1990 ACO.

REFER TO TABLES 116-01 AND 116-06 FOR IDENTIFICATION OF DATA SOURCES.

R116-02 07/12/01 PLOT 1=80 (R116-01.PCP)

80 0 80 160

scale feet

NO.	REVISIONS	REV'D BY	DATE	APPRO'D BY

BROWN AND CALDWELL

MAHWAH, NEW JERSEY

SCALE: AS SHOWN

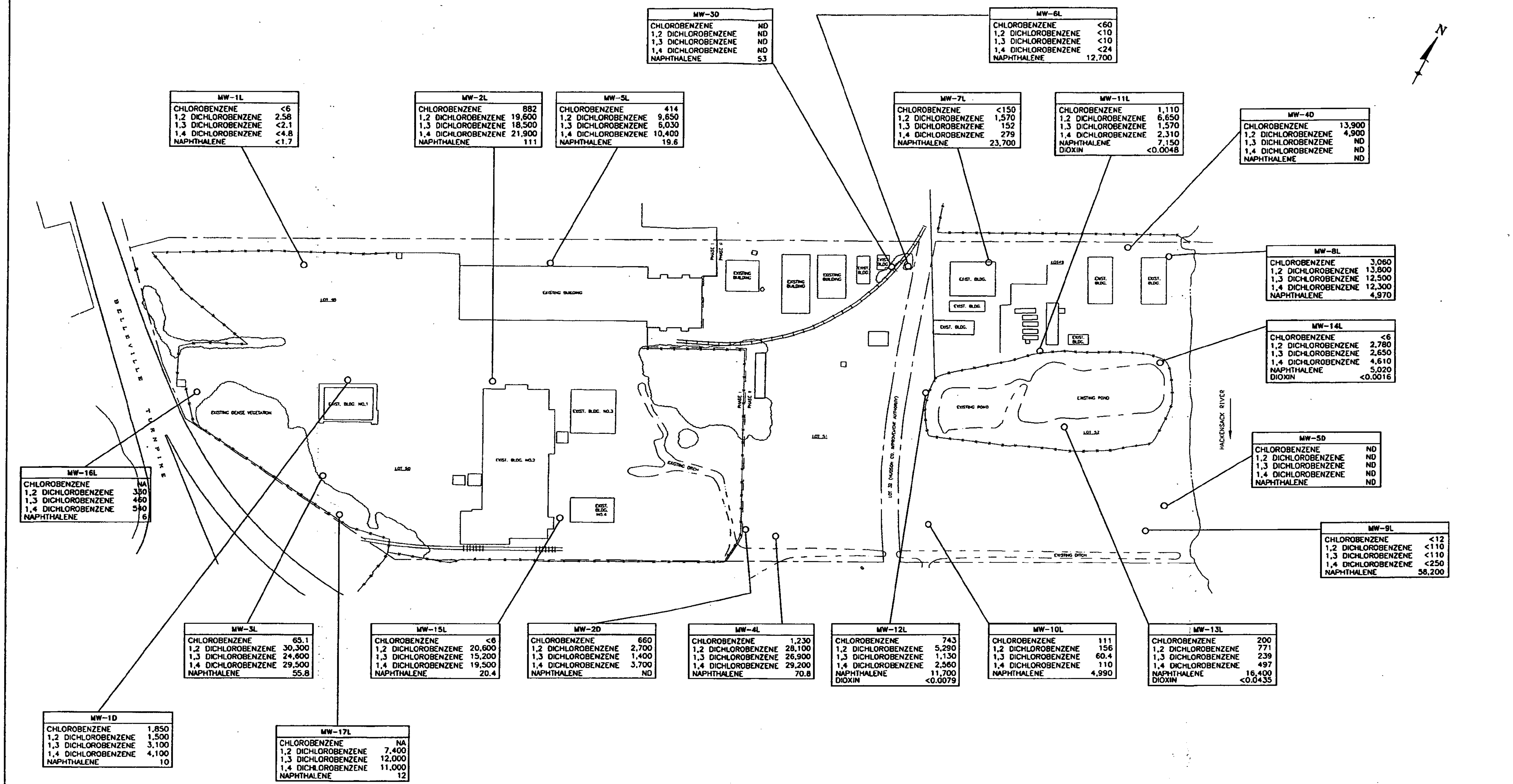
DRAWN BY	DATE	CHECKED BY	APPROVED BY
JHM	6/01	JCS	WGS

STANDARD CHLORINE
SITE NO. 116
KEARNY, NEW JERSEY

CHLOROBENZENES, NAPHTHALENE AND DIOXIN IN UPPER WATER-BEARING ZONE AND SURFACE WATER (μg/L)

SUBREGION I

FIGURE 116-2.11



LEGEND

MW-1 O PREVIOUSLY INSTALLED MONITORING WELL

MW-4L	
CHLOROBENZENE	1,230
1,2 DICHLOROBENZENE	28,100
1,3 DICHLOROBENZENE	26,900
1,4 DICHLOROBENZENE	29,200
NAPHTHALENE	70.8

SAMPLE LOCATION NUMBER

CONCENTRATION ($\mu g/L$)

NOTE: DIOXIN CONCENTRATIONS REFER TO 2,3,7,8-TCDD.

L- LOWER WATER-BEARING ZONE WELL

D- LOWER WATER-BEARING ZONE WELL

ND- NOT DETECTED

NA- NOT ANALYZED

PROPERTY LINE

RIGHT OF WAY LINE

FENCE LINE

EXISTING STRUCTURE

80 0 80 160

scale feet

NOTES: THIS FIGURE IS AN INTEGRAL PART OF THE RI WORK PLAN PREPARED IN RESPONSE TO THE APRIL 17,1990 ACO.

REFER TO TABLES 116-01 AND 116-06 FOR IDENTIFICATION OF DATA SOURCES.

NO.	REVISIONS	REV'D BY	DATE	APPRO'D BY

BROWN AND CALDWELL
MAHWAH, NEW JERSEY

STANDARD CHLORINE
SITE NO. 116
KEARNY, NEW JERSEY

CHLOROBENZENES, NAPHTHALENE AND DIOXIN CONCENTRATIONS IN GROUNDWATER LOWER WATER-BEARING ZONE ($\mu g/L$)

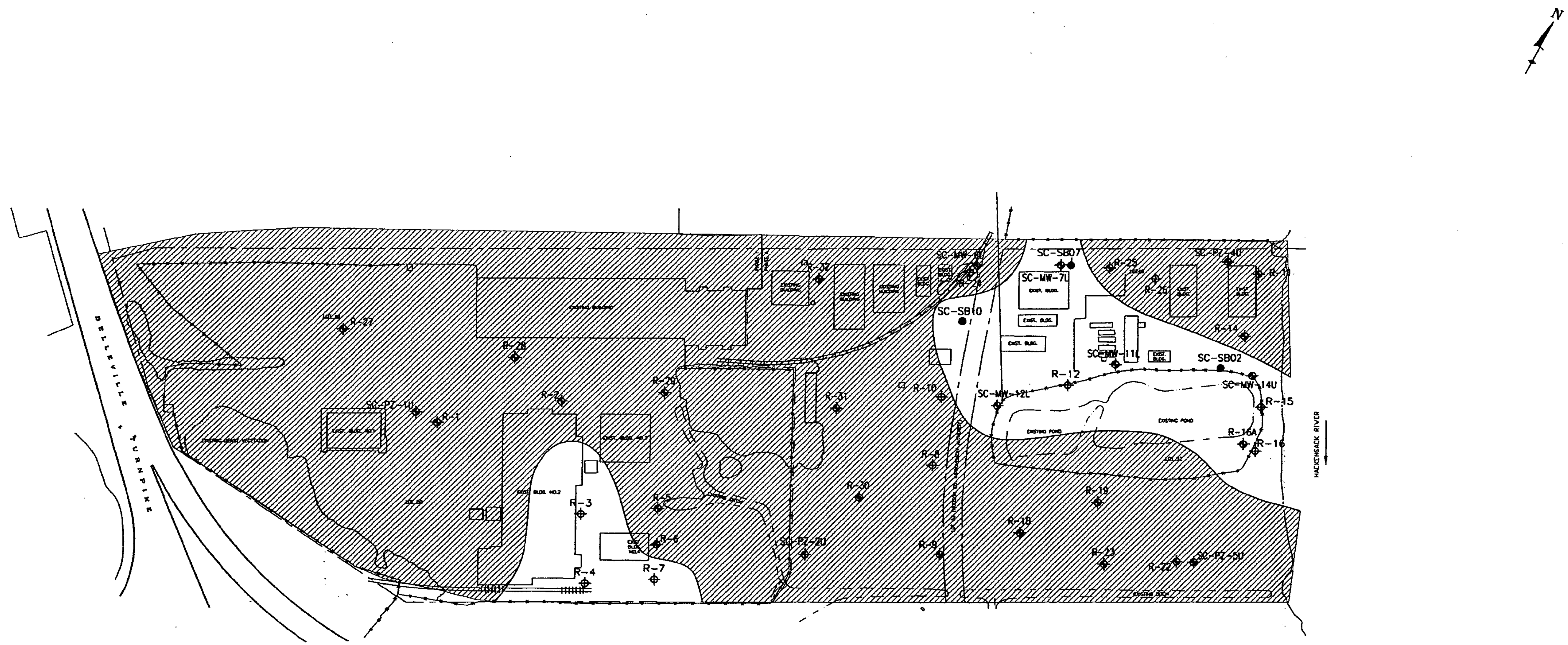
SCALE: AS SHOWN

DRAWN BY	DATE	CHECKED BY	APPROVED BY
JHM	6/01	JCS	WGS

SUBREGION I

FIGURE 116-2.12

R116-01 07/12/01 PLOT 1-80 (R116-01.PCP)



LEGEND

R-15 — DNAPL PRESENCE DETECTED IN ROST BORING

SC-SB02 — DNAPL PRESENCE DETECTED IN SOIL BORING

SC-MW-12L — DNAPL PRESENCE DETECTED IN MONITORING WELL

DNAPL NOT DETECTED

PROPERTY LINE

RIGHT OF WAY LINE

FENCE LINE

EXISTING STRUCTURE

80 0 80 160

scale feet

NOTES: THIS FIGURE IS AN INTEGRAL PART OF THE RI WORK PLAN PREPARED IN RESPONSE TO THE APRIL 17,1990 ACO.

*- INFERRED DNAPL INDICATES POTENTIAL POOLED OR RESIDUAL DNAPL.

SOURCE: TAKEN FROM FIGURE 3-4 OF SUPPLEMENTAL REMEDIAL INVESTIGATION (KEY ENVIRONMENTAL INC., APRIL, 1999).

NO.	REVISIONS	REV'D BY	DATE	APPRO'D BY

BROWN AND CALDWELL

MAHWAH, NEW JERSEY

SCALE: AS SHOWN

DRAWN BY	DATE	CHECKED BY	APPROVED BY
JHM	6/01	JCS	WGS

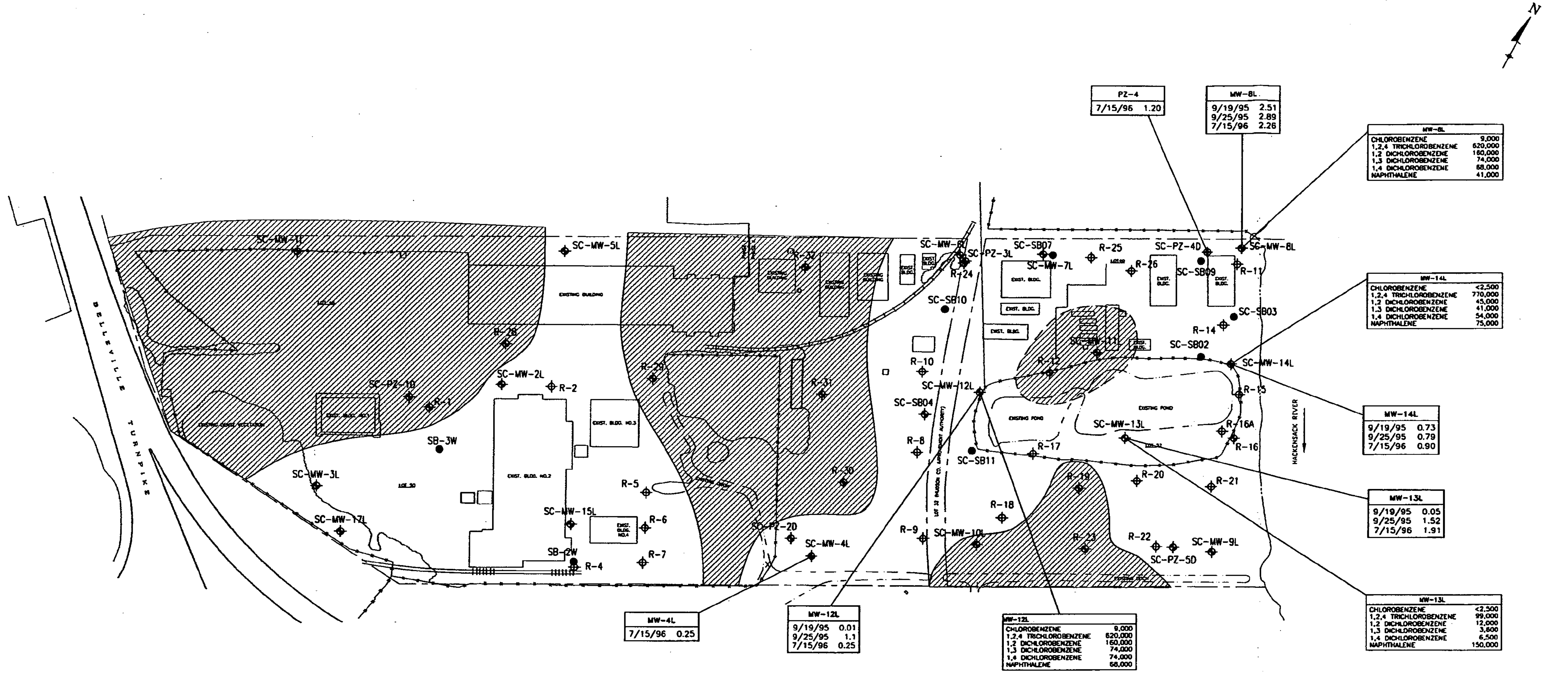
STANDARD CHLORINE
SITE NO. 116
KEARNY, NEW JERSEY

INFERRED DNAPL DISTRIBUTION ABOVE MEADOW MAT*

SUBREGION I

FIGURE 116-2.13

RI116-22 07/11/01 PLOT 1=80 (RI116-21.PCP)



LEGEND

R-15	DNAPL PRESENCE DETECTED IN ROST BORING
SC-SB02	DNAPL PRESENCE DETECTED IN SOIL BORING
SC-MW-15L	DNAPL PRESENCE DETECTED IN MONITORING WELL
	DNAPL NOT DETECTED
MW-12L	SAMPLE LOCATION NUMBER
9/19/95 0.01 9/25/95 1.1	DNAPL THICKNESS MEASURED ON DATE INDICATED (ft.)

PROPERTY LINE
RIGHT OF WAY LINE
FENCE LINE
EXISTING STRUCTURE

NOTES: THIS FIGURE IS AN INTEGRAL PART OF THE RI WORK PLAN PREPARED IN RESPONSE TO THE APRIL 17,1990 ACO.

*- INFERRED DNAPL INDICATES POTENTIAL POOLED OR RESIDUAL DNAPL.

SOURCE: TAKEN FROM FIGURE 3-4 OF SUPPLEMENTAL REMEDIAL INVESTIGATION (KEY ENVIRONMENTAL INC., APRIL, 1999).

80 0 80 160
scale feet

NO.	REVISIONS	REV'D BY	DATE	APPRO'D BY

BROWN AND CALDWELL
MAHWAH, NEW JERSEY

STANDARD CHLORINE
SITE NO. 116
KEARNY, NEW JERSEY

INFERRED DNAPL DISTRIBUTION BELOW MEADOW MAT*

SCALE: AS SHOWN

DRAWN BY	DATE	CHECKED BY	APPROVED BY
JHM	6/01	JCS	WGS

SUBREGION I

FIGURE 116-2.14

RI116-21 06/26/01 PLOT 1=80 (RI116-21.PCP)

3.0 PROPOSED RI SAMPLING PLAN – SITE 116

3.1 OBJECTIVES

In accordance with Appendix B of the ACO, the objectives of the proposed RI are to:

- Fully characterize COPR, Cr, and its compounds, whether or not any hazardous substances or pollutants are intermingled therewith, which are, or may be the source(s) of air, soil, surface water, and groundwater pollution at the site.

- Fully determine the nature, type, and physical states of air, soil, surface water, and groundwater pollution at the site, emanating from the site or which has emanated from the site.

- Fully determine the horizontal and vertical extent of pollution at the site, emanating from the site or which has emanated from the site.

- Fully determine migration paths of pollutants through air, soil, groundwater, surface water, and sediment.

- Fully determine impact of the air, soil, surface water, and groundwater pollution on human health and the environment.

- Address the potential for natural resource injuries by conducting an ecological risk evaluation.

- Collect, present, and discuss all data necessary to adequately support the development of a feasibility study and the selection of a remedial action alternative that will remedy the adverse impacts of the pollution on human health and the environment.

3.2 TECHNICAL APPROACH

As presented in Section 2.2, data collected during previous investigations have fulfilled many of the objectives required under the ACO. It is clear for example, that soil and groundwater both above and below the meadow mat are highly contaminated with VOCs/SVOCs. The distribution of these constituents has been defined from numerous soil and groundwater samples and is shown to be widespread throughout the site. Thus, additional investigation for VOCs/SVOCs in soil or groundwater is not proposed in this RIWP.

With respect to Cr in soil, it is known from the site history that COPR has been placed above the meadow mat across the majority of the site. However, relatively few subsurface soil samples have been collected for the analysis of Cr. Thus, additional shallow soil borings are proposed to assess the concentrations of total Cr and Cr(VI) in the soils above the meadow mat as discussed in Section 3.3.1. Considering that COPR was only placed above the meadow mat and total Cr values in soil samples from beneath the meadow mat exhibited concentrations consistent with background in New Jersey soils (Dragun and Chiasson, 1991), no additional soil samples are proposed below the meadow mat.

With respect to Cr in groundwater, the existing data indicate the presence of elevated Cr(VI) in the upper water-bearing zone, but not in the lower water-bearing zone, which is consistent with findings at adjacent Site 113 (Diamond). However, considering the importance of this issue, and since only one complete round of groundwater samples has been collected at Site 116 for Cr analysis, additional groundwater sampling in both the upper and lower water-bearing zones for total Cr and Cr(VI) is proposed in Section 3.3.2. The proposed sampling will include both filtered and unfiltered samples for comparison.

Investigation of Cr in the bedrock is not proposed due to the presence of the thick sequence of low permeability varved clay between the lower water-bearing zone and the bedrock. As shown on Figure 116-3.2, the varved clay is approximately 60 feet thick beneath the Site and forms a formidable confining layer with respect to the bedrock. The presence of this confining layer and the fact that Cr(VI) was not detected within the lower water-bearing zone, all but precludes the possibility of Cr migration into the bedrock. The measured concentrations of total Cr in the former production well prior to its abandonment are suspect for several reasons. First, the reported results from different intervals in the water column were very close in concentration, yet the samples were not filtered. Secondly, the samples were collected at locations with hundreds of feet of vertical separation within the well. Thirdly, none of the VOC/SVOC constituents of interest (i.e., chlorobenzenes, naphthalene) that have passed through the meadow mat and form DNAPL in the lower water-bearing zone were detected in the production well samples, indicating that there has been no communication between groundwater in the bedrock and groundwater in the water-bearing zones above the varved clay confining layer.

If Cr actually was present within groundwater in the bedrock, the only plausible route of downward migration from the Site, considering the thickness and low permeability of the varved clay, would have been along the well casing of the production well itself. Considering the relatively small diameter of the well, the impact of such vertical cross-contamination would likely be limited. In consideration of the above, and since this well has been abandoned (sealed) and cannot be re-sampled, further evaluation of the groundwater quality in the bedrock (i.e., the installation of additional wells) is not warranted at this time.

The distribution of the existing groundwater monitoring wells is considered sufficient to adequately characterize the site, and thus the installation of additional groundwater monitoring wells is not proposed. Likewise, the existing data have adequately demonstrated that the meadow mat is present and is intact across the entire site (as reported in boring logs). Structural contour maps illustrating the topographic relief of the top of the meadow mat have been prepared by previous investigators (i.e., Documents 12 and 20). Based on these data, the continuity and presence of the meadow mat is expected to continue to provide a geochemical barrier to the downward migration of Cr(VI). Thus, additional borings to define the presence of the meadow mat are not proposed in this RIWP.

One of the key issues to be addressed in the subsequent development of remedial options for Cr at the site, is the degree (if any) to which Cr is commingled with the pooled DNAPL. The distinction between pooled and residual DNAPL is important since only the pooled or "free" DNAPL is mobile within the porous media of the upper and lower water-bearing zones, and thus is subject to removal by pumping. Residual DNAPL on the other hand, consists of free-phase liquid that is trapped within the pores of the soil and is, therefore, not "free" or mobile in the subsurface. Remediation of residual DNAPL is typically not feasible, with the exception of complete excavation and removal. At Site 116, the DNAPL is in the lower water-bearing zone, beneath the geochemical barrier, so that excavation and removal is not a viable option.

Considerable research has been conducted on the occurrence and migration of DNALP in the subsurface by Friedrich Schwille of the Federal Institute of Hydrology in Koblenz, West Germany (Schwille, 1981, 1984). Schwille's work has involved small and large scale laboratory studies of the penetration of DNAPLs into unsaturated and saturated soils. His findings showed that the downward migration of DNAPL through the soil is quite rapid in all but fine-grained soils. As it moves vertically downward, the DNAPL leaves a trail of free-phase liquid on the soil in the form of a "residual" DNAPL. Residual DNAPL, by definition, occurs as coatings on individual soil grains, droplets (globules) within the pore spaces between soil grains, or as isolated groups of droplets (ganglia). Since the residual DNAPL is not a continuous layer or zone, it is unable to migrate, even in the presence of moving groundwater. It does however, provide an effective "source" for dissolved-phase contamination in the groundwater that moves through the zone of residual DNAPL.

If the downward migrating DNAPL encounters a low permeability layer, such as the varved clay at Site 116, it will form a pool of DNAPL (Schwille, 1981). Since pooled DNAPL fully saturates the soil pores and is a continuous layer, it is able to migrate down the slope of the confining unit. Schwille's work has shown that the pooled DNAPL will move in the direction of the slope of the confining layer, regardless of the direction of groundwater flow. It does so relatively quickly after its release into the soil and tends to remain in the depressions of the confining layer without a great deal of subsequent movement. Groundwater flowing across the top of the pooled DNAPL will also solubilize its constituents and form a dissolved phase plume. However, the surface area of the pooled DNAPL is typically much smaller than the surface area of the overlying residual DNAPL, and thus contributes less to the total mass in the dissolved phase plume. Figure 116-3.1 illustrates the differences between residual and pooled DNAPL in porous media.

Remediation of the residual DNAPL at Site 116 may not be feasible using conventional remedial technologies considering the magnitude of its distribution as inferred from Figures 116-2.13 and 116-2.14. If Cr(VI) is not present within the pooled DNAPL, then remediation of the pooled DNAPL (if required) is considered outside the scope of April 17, 1990 ACO.

Based on this assessment, it is proposed that a phased approach be implemented with respect to DNAPL sampling. The first phase will consist of the collection of pooled DNAPL samples from selected existing monitoring wells for analysis of total Cr and Cr(VI). If Cr(VI) is not commingled with the DNAPL, then no further investigation of the properties or extent of the DNAPL would be required. If Cr(VI) is present in concentrations greater than 100 ug/L within the DNAPL, a second phase would be implemented that would include further delineation of the extent of the pooled DNAPL and its physical properties. These data would be needed for subsequent treatability studies and/or the FS. Sampling of residual DNAPL within the soil is not proposed in this RIWP for the reasons described above.

With respect to surface water and sediments, the existing data has sufficiently characterized the presence of Cr and VOCs/SVOCs on-site as discussed in Section 2.2.4. Additional sampling is proposed in the Hackensack River however, as part of an ecological risk assessment to be conducted for Cr. Sediment data collected in the river by Enviro-Sciences (January, 2000b) indicated the presence of Cr(VI) in several samples. However, these results may not be accurate due to possible turbidity and/or color interferences that may result in false positive Cr(VI) results in sediment samples. Appropriate analytical techniques, as designated below, will be utilized to address this concern.

3.3 PROPOSED SAMPLING

3.3.1 Proposed Soil Sampling

Six soil borings will be conducted for the collection of soil samples from the fill above the meadow mat. The locations of the borings are shown on Figure 116-2.15 and were chosen to supplement data from the previously conducted borings shown on Figures 116-2.4 and 116-2.5. A GeoProbe® will be used to collect the soil samples in continuous 2-foot intervals from the ground surface to the top of the meadow mat in accordance with the procedures in the project control documents. Each soil sample will be analyzed in the laboratory for total Cr, Cr(VI), ORP, and pH. Temperature, ORP, and pH will also be measured in the field.

3.3.2 Proposed Groundwater/DNAPL Sampling

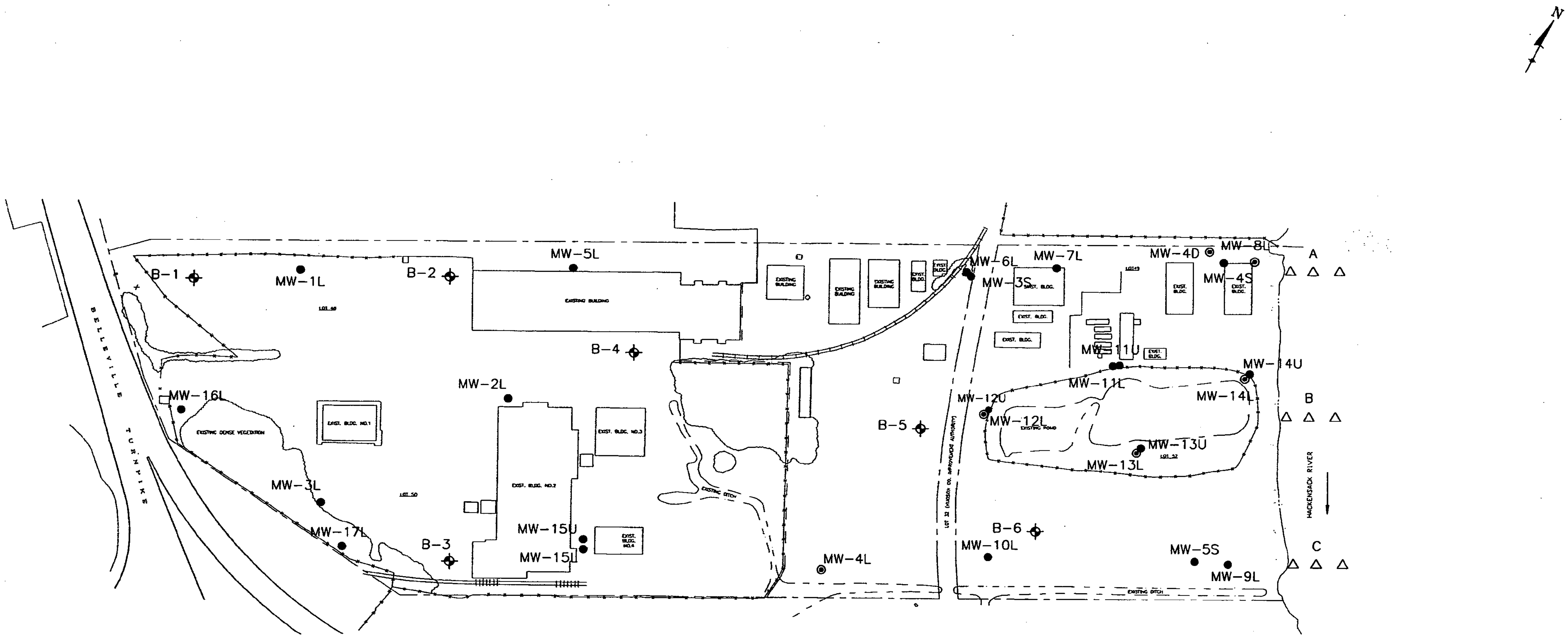
Groundwater samples will be collected from a total of 26 previously installed monitoring wells. These include 8 shallow wells screened in the upper water-bearing zone, and 18 deep wells screened in the lower water-bearing zone as shown on Figure 116-2.15. The samples will be collected using the low-flow procedures described in the project control documents. Both filtered samples and unfiltered samples will be collected for analysis of total Cr and Cr(VI).

Prior to groundwater sample collection, the presence and thickness of DNAPL will be assessed in each monitoring well with an interface probe in accordance with the procedures described in the project control documents. Based on previous investigations, it is expected that DNAPL may be present in 6 of the deep monitoring wells as identified on Figure 116-2.15. A sample of the DNAPL will be collected from each of the six wells in accordance with the procedures in the project control documents and analyzed for VOCs/SVOCs, total Cr, and Cr(VI). Both a filtered sample and an unfiltered sample will be analyzed. Samples will be filtered in the laboratory to avoid prolonged contact with the DNAPL by field personnel. Additionally, if DNAPL is encountered in any of the other wells that are to be sampled, a DNAPL sample will be collected for analysis of these same parameters.

3.3.3 Proposed Surface Water and Sediment Sampling

Surface water samples will be collected from the central location in each of the three transects in the Hackensack River as shown on Figure 116-2.15. These locations will provide data from upstream, downstream, and abeam of the site. The samples will be collected from a boat in accordance with the procedures described in the project control documents. Each sample will be analyzed for total Cr, Cr(VI), pH, ORP, DO and conductivity. Field measurements will be made for each of these parameters except total Cr and Cr(VI).

Sediment samples will be collected from each of three locations along the three transects shown on Figure 116-2.15. At each location, samples will be collected from the one, five and ten-foot depth interval (below the riverbed surface). A total of 27 sediment samples will therefore be collected for analysis of total Cr, Cr(VI), pH, and ORP. The samples will be collected from a boat using a hand driven GeoProbe® sampler in accordance with the procedures in the project control documents. For Cr(VI), both the NJDEP-modified methods and SW-846 Methods 3060A/7196A will be used in parallel for analysis of the sediment samples to address concerns mentioned above regarding potential turbidity



LEGEND

B-1	SHALLOW BORING
A	SURFACE WATER/SEDIMENT TRANSECT
MW-8L	GROUNDWATER SAMPLE (FROM EXISTING MONITORING WELL)
MW-12L	GROUNDWATER AND DNAPL SAMPLE (FROM EXISTING MONITORING WELL)
	PROPERTY LINE
	RIGHT OF WAY LINE
	FENCE LINE
	EXISTING STRUCTURE

NOTES: THIS FIGURE IS AN INTEGRAL PART OF THE RI WORK PLAN PREPARED IN RESPONSE TO THE APRIL 17,1990 ACO.

IF DNAPL IS ENCOUNTERED AT ANY MONITORING WELL WHEN SAMPLING FOR GROUNDWATER, A SAMPLE OF THE DNAPL WILL ALSO BE COLLECTED FOR SELECTIVE PARAMETER ANALYSIS OR CHARACTERIZATION.

SOURCE:

PREVIOUS SAMPLE LOCATIONS AND SITE FEATURES OBTAINED FROM VARIOUS SOURCES (REFER TO TABLE 116-01). BROWN & CALDWELL ASSUMES NO RESPONSIBILITY FOR ACCURACY OF SAME.

80 0 80 160
scale feet

R116-28 07/12/01 PLOT 1=80 (R116-28.PCP)

NO.	REVISIONS	REV'D BY	DATE	APPRO'D BY

BROWN AND CALDWELL
MAHWAH, NEW JERSEY

STANDARD CHLORINE
SITE NO. 116
KEARNY, NEW JERSEY

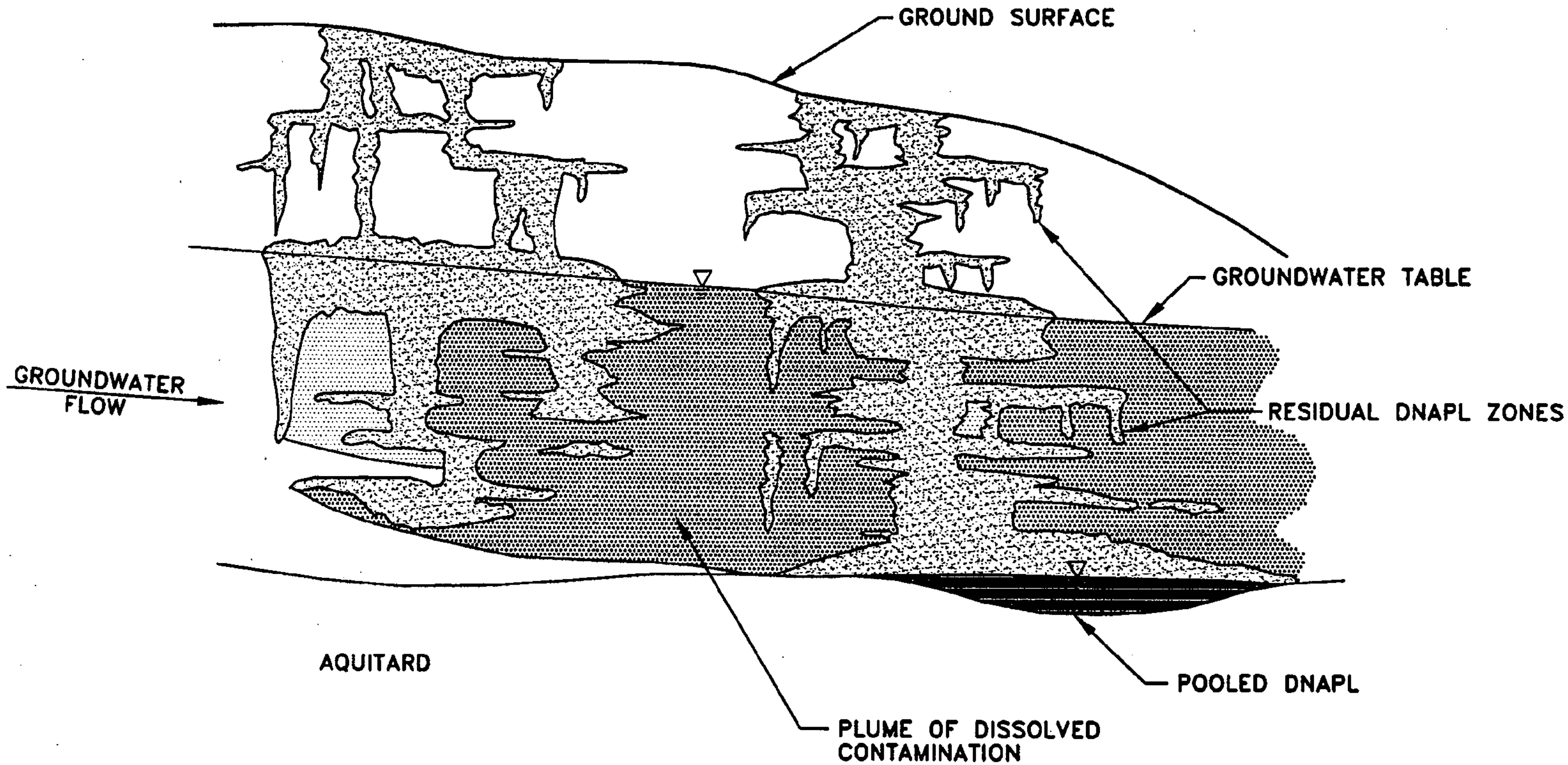
PROPOSED RI SAMPLE LOCATIONS

SCALE: AS SHOWN

DRAWN BY	DATE	CHECKED BY	APPROVED BY
PL	06/01	JCS	WGS

SUBREGION I

FIGURE 116-2.15



NOTE:
NOT TO SCALE.

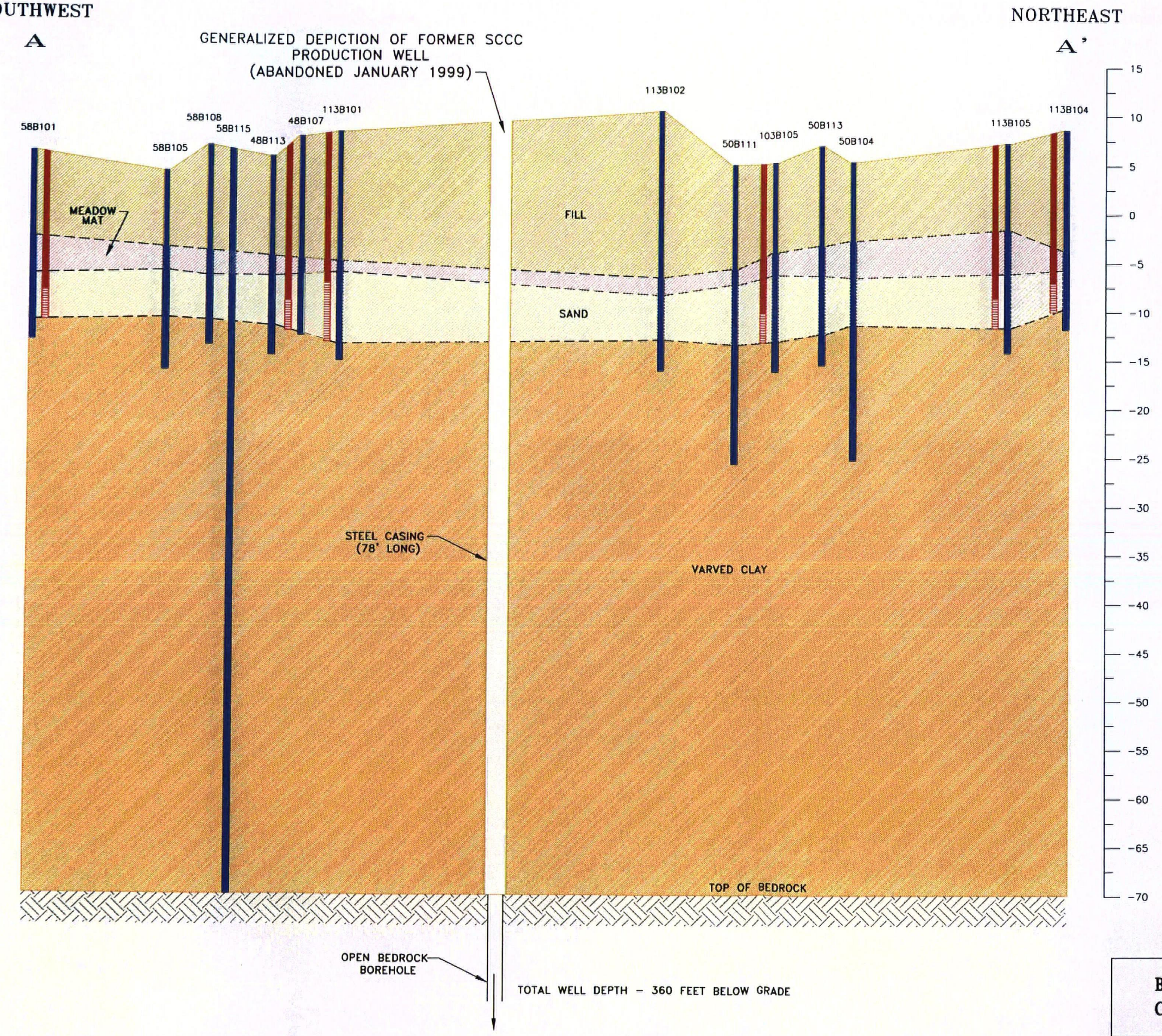
FIGURE 116-3.1

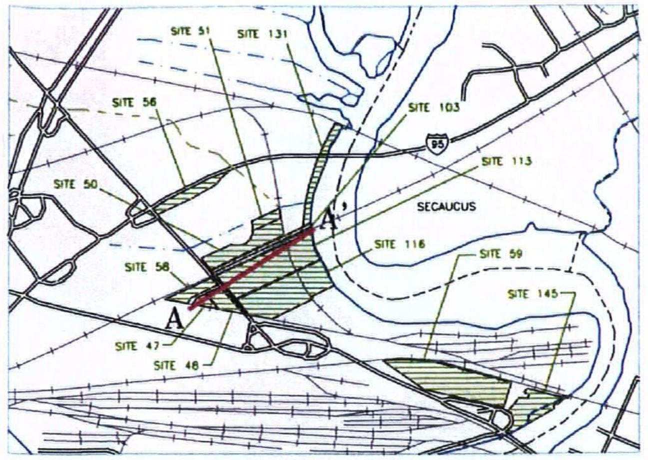
TYPICAL DNAPL BEHAVIOR
IN POROUS MEDIA

STANDARD CHLORINE
SITE NO. 116
KEARNY, NEW JERSEY

BROWN AND
CALDWELL Mahwah, New Jersey

RI116-30 06/22/01 PLOT 1=1 (RI116-30.PCP)





CROSS-SECTION LOCATION MAP

LEGEND

- FILL MATERIAL
- MEADOW MAT MATERIAL
- FINE SAND
- CLAY
- INFERRED BOUNDARY
- WELL CASING
- WELL SCREEN
- BORING INTERVAL
- MSL — MEAN SEA LEVEL

NOTE: THIS CROSS-SECTION REPRESENTS AN EXTRAPOLATION OF BORING LOGS ALONG THE CROSS-SECTION LINE A-A'. THICKNESS OF INDIVIDUAL UNITS AT EACH BORING LOCATION DOES NOT NECESSARILY CORRESPOND TO SPECIFIC BORING LOGS.

VERTICAL EXAGGERATION: 14X

SCALE IN FEET (0, 70, 140; vertical 5, 10)

NO.	REVISIONS	REV'D BY	DATE	APPRO'D BY

BROWN AND CALDWELL
MAHWAH, NEW JERSEY

HACKENSACK MEADOWLANDS
SUBREGION I
KEARNEY, NEW JERSEY

GENERALIZED GEOLOGIC CROSS-SECTION VICINITY OF SITE 113

SCALE: AS SHOWN

DRAWN BY	DATE	CHECKED BY	APPROVED BY
JHM	6/00	WGS	WGS

SUBREGION I | FIGURE 116-3.2

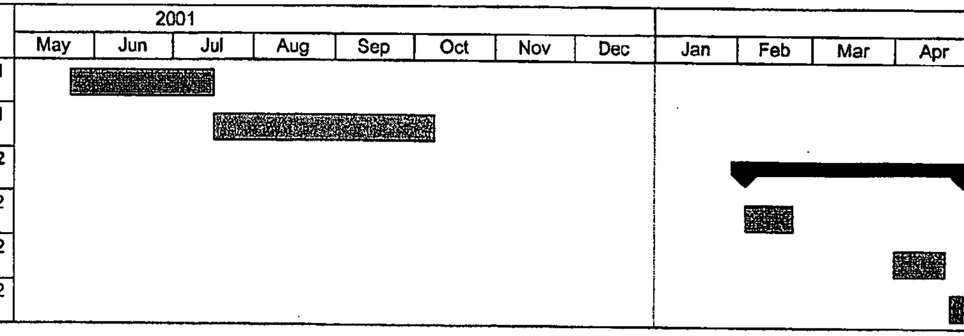
B116-31 07/13/01 PLOT 1=1 (B116-31.PCP)

4.0 SCHEDULE

A schedule for the implementation of the proposed field investigation at Site 116, as described in this RIWP, is presented in Table 4-1.

TABLE 4-1
Remedial Investigation Field Schedule
Site 116 - Standard Chlorine Chemcial Company

ID	Task Name	Duration	Start	Finish
1	Remedial Investigation Work Plan (RIWP)	39 days	Wed 5/23/01	Mon 7/16/01
2	RIWP Review / Approval	60 days	Tue 7/17/01	Mon 10/8/01
3	**Remedial Investigation Field Work**	**60 days**	**Mon 2/4/02**	**Fri 4/26/02**
4	Soil Borings	14 days	Mon 2/4/02	Thu 2/21/02
5	Groundwater Sampling	15 days	Mon 4/1/02	Fri 4/19/02
6	Sediment Sampling	5 days	Mon 4/22/02	Fri 4/26/02



1) Remedial Investigation activies are subject to obtaining access from the site owners.
2)The implementation of field activities should be subject to favorable weather conditions.

Task | Split | Progress | Milestone | Summary | Rolled Up Task | Rolled Up Split | Rolled Up Milestone | Rolled Up Progress | External Tasks | Project Summary

P:\COPR\20741\RAWP\Site116schedule

REFERENCES

Administrative Consent Order. 1989. Administrative Consent Order in the Matter of Standard Chlorine Chemical Corporation (SCCC) executed between the New Jersey Department of Environmental Protection and Energy (NJDEPE) and SCCC. October 20.

Brown and Caldwell. 2000. Letter to NJDEP, "Results of Surface Water Sampling of Ditch at Site 116 (Standard Chlorine)". July 18.

Brown and Caldwell. 2001. Remedial Investigation Report, Site 113 (Diamond Site), Volumes I and II, April.

Dragun, J. and A. Chiasson, 1991. Elements in North American Soils. Hazardous Materials Control Resources Institute, Greenbelt, MD.

E.C. Jordan Co. 1985. Phase II Dioxin investigation for SCCC Site prepared for USEPA. December 19.

Enviro-Sciences, Inc. 1999. Conceptual Remedial Action Work Plan for SCCC Site, Kearny, NJ. October 19.

Enviro-Sciences, Inc. 2000a. Letter to NJDEP re historic analytical data for asbestos containing material and other drummed materials. October 23.

Enviro-Sciences, Inc. 2000b. Remedial Action Workplan submitted to New Jersey Department of Environmental Protection, November.

JRB Associates, 1995. Letter to NJDEP transmitting draft engineering report for SCCC site referencing use of lagoons prior to SCCC purchase of site. May 17.

Key Environmental, Inc. 1999. Supplemental Remedial Investigation, Standard Chlorine Chemical Company, Inc., Kearny, NJ, April.

Lowenstein, Sandler, Kohl, Fisher & Boylan. 1989a. Letter to NJDEP in response to proposed ACO discusses site use by former owners, production materials, and products, and includes excerpts of operating procedures manual for Koppers Meadows Plant (Oct. 1954). July 14.

Lowenstein, Sandler, Kohl, Fisher & Boylan. 1989b. Letter to NJDEP transmitting information on Site 116 ownership, operating procedures manual for Koppers meadows Plant, and daily production records. August 2.

Lowenstein, Sandler, Kohl, Fisher & Boylan. 1993. Letter to NJDEP transmitting General Information Submittal for cessation of operations at Kearny, NJ, Block 287; Lot 50. April 27.

REFERENCES (CONTINUED)

NJDEP, 1983. Letter from NJDEP Division of Water Resources to SCCC claiming that past landfilling, storage, spillage and waste disposal activities at Site 116 have polluted groundwater and surface water in violation of State law. February 28.

NJDEP, 1986. .Letter from NJDEP to SCCC transmitting results of Phase II Dioxin Study indicating that 2,3,7,8 -TCDD found in soil samples at SCCC facility during May 1985 sampling campaign. June 9.

NJDEP. 2001a. Letter from NJDEP to USEPA Region II requesting removal CERCLA removal action consideration for Standard Chlorine Chemical Co. Site. January 25.

Roy F. Weston (Weston). 1983. Letter to SCCC on Hydrogeological Investigation at Standard Chlorine Chemical Company Inc., Kearny, NJ. June 6.

Schwille, F. 1981. Groundwater Pollution in Porous Media by Fluids Immiscible in Water". The Science of the Total Environment, v. 21.

Schwille, F. 1984. Migration of Organic Fluids Immiscible with Water in the Unsaturated Zone". In: Pollutants in Porous Media – The Unsaturated Zone Between Soil Surface and Groundwater, Edited by B. Yaron, G. Dagan and J. Goldshmid, Springer-Verlag, New York.

Weston. 1984. Hydrogeologic Investigation Report for SCCC. January 19.

Weston. 1987. Stage I Analyses Report for Sampling Analyses Pertaining to Dioxin-Contaminated Materials and Waste Lagoons (Volumes I, II, and III). September.

Weston. 1988. Stage II and III Analyses Report for Sampling Analyses of Potentially Dioxin-Contaminated Materials in Waste Lagoons. May 19.

Weston. 1993. Draft Remedial Investigation Standard Chlorine Chemical Company Inc. and Standard Naphthalene Products, Inc. Properties, Kearny, NJ, May.

SCCC, 1980. Potential hazardous waste site identification and preliminary assessment form submitted to U.S. Environmental Protection Agency (USEPA). September 12.

SCCC, 1983. Letter to NJDEP transmitting production information on trichlorobenzene and orthodichlorobenzene. October 4.

USEPA, 1997. SW-846 Test Methods for Evaluating Solid Waste, Physical/Chemical Method, Update III to 3rd Ed., *Fed. Reg.*, *62*:114, 32452-32462 (6-13-97).

A

APPENDIX A

HEALTH AND SAFETY PLAN (HASP)

HEALTH AND SAFETY PLAN (HASP)
FOR THE
REMEDIAL INVESTIGATION AT
CHROMITE ORE PROCESSING RESIDUE SITE 116
(STANDARD CHLORINE)
KEARNY, NEW JERSEY

Prepared for:

Chemical Land Holdings, Inc.
Two Tower Center Blvd., 10th Floor
East Brunswick, New Jersey 08816

Prepared by:

Brown and Caldwell
440 Franklin Turnpike
Mahwah, New Jersey 07430

July 2001

19312.001

TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

This Health and Safety Plan (HASP) includes health and safety procedures that will be followed during the conduct of onsite Remedial Investigation (RI) activities outlined in the RI Work Plan for the Chromite Ore Processing Residue (COPR) Site 116 in Kearny, New Jersey under the New Jersey Department of Environmental Protection (NJDEP) Administrative Consent Order (ACO) dated April 17, 1990 issued to Occidental Chemical Company (OCC) and Chemical Land Holdings (CLH).

This document is an integral part of the RI Work Plan (RIWP) dated July 2001, and will be used in concert with the project-specific Standard Investigative Procedures Plan (SIPP), Equipment Decontamination Plan (EDP) and Quality Assurance Project Plan (QAPP). This HASP has been developed to protect the health and safety of the onsite project personnel and the public, and to protect the environment against damage during RI activities.

This HASP has been developed for use during investigative activities at the site. The Health and Safety Program includes assignment of key personnel and responsibilities, training and medical surveillance requirements, general safe work practices, hazard assessment, personal protection requirements, work zones, air quality monitoring, and decontamination procedures. This HASP covers the site work practices required for potential physical and chemical hazards. In addition, details for emergency response, site control, and record keeping are included.

The procedures presented in this HASP are consistent with the following regulatory or guidance documents:

- Occupational Safety and Health Association (OSHA) Regulations, 29 CFR 1910/1926, U.S. Department of Labor, Occupational Safety and Health Administration, OSHA, March 7, 1996.

- NIOSH/OSHA/USCG/USEPA, Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, October 1985.

Personnel involved in intrusive activities under this RIWP will be required to follow the HASP protocols, as directed by the On-site Health and Safety Officer (HSO). In addition, the subcontractor(s) will be required to designate an On-site HSO for their personnel and to follow, at a minimum, the requirements of this HASP.

Brown and Caldwell will require official certifications indicating that Brown and Caldwell and subcontractor field personnel who will be involved in intrusive activities have completed the appropriate waste site worker training prior to site entry, as required by OSHA 1910.120(e)(2), 1910.120(e)(3), and 1910.120(e)(8), as applicable, and the required medical surveillance as required by OSHA 1910.120(f). Copies of training certificates and documents demonstrating enrollment in a medical surveillance program will be maintained at Brown and Caldwell's corporate office and will be available for review.

2.0 RESPONSIBILITIES

A qualified individual and a backup, if necessary, will be designated for each key Health and Safety support position. The names of key individuals and backup persons, if necessary, will be submitted to the NJDEP at least 24 hours before the initial startup of field RI activities at the site. If changes in personnel are necessary, this will be reflected on the daily sign-in sheet.

2.1 PROJECT HEALTH AND SAFETY OFFICER

The responsibilities of the Project HSO are to develop and coordinate the Site Health and Safety Program (with the assistance of an executive level Certified Industrial Hygienist [CIH]) and provide necessary direction and supervision to the On-site HSO. The Project HSO will conduct the initial site-specific training session and will review and confirm changes in personal protection requirements (with the assistance of an executive level CIH) when site conditions are found to be different than those originally anticipated.

The Project HSO will be involved in the initial discussions on health and safety matters with the NJDEP, United States Environmental Protection Agency (EPA), OSHA, local health authorities, responsible party, or other governmental or labor representatives. In addition, this individual will provide the On-site HSO with details concerning the task-specific health and safety considerations. If necessary, Brown and Caldwell will designate a qualified backup for the Project HSO. The Project HSO will have at least three years experience in the practice of health and safety at hazardous waste sites containing contaminants known to exist on Site 116.

2.2 ON-SITE HEALTH AND SAFETY OFFICER

The responsibilities of the On-site HSO are as follows:

- Implement this HASP on-site.

- Enforce standard, day-to-day health and safety protocols.

- Require that all workers who will be involved in intrusive activities on the sites have had appropriate waste site worker training and medical examinations, and review and maintain training and medical records on-site.

- Require that all personnel entering the site understand the provisions of this HASP and have the required training for site-specific hazards and activities to be conducted on-site.

- Conduct periodic training sessions in proper use and maintenance of personal protective equipment and safety practices.

- Conduct periodic emergency response drills.

- Conduct daily health and safety meetings at the beginning of each day's activities.

- Direct on-site Brown and Caldwell personnel, visitors, subcontractor(s) and HSO(s) on all aspects, especially changes, related to health and safety requirements at the Site.

- Conduct necessary health and safety monitoring.

- Monitor site conditions and determine all necessary changes to levels of personal protection and, if warranted, execute work stoppages.

- Report changes in site conditions and personal protection requirements to the Project HSO, as necessary.

- Prepare accident/incident reports, as necessary.

The On-site HSO will be the senior Brown and Caldwell staff person present with appropriate training, education (40 hour initial, 8 hour supervisory, or equivalent) and two years experience with the monitoring and control of health and safety hazards at hazardous waste sites. If necessary, Brown and Caldwell will designate a qualified backup for the On-site HSO.

The following personnel have been designated as HSOs for remedial investigation activities at Site 116. These individuals are senior field supervisory personnel with a minimum of 40 hrs Hazardous Waste and Emergency Response training, 8 hours supervisory training, previous experience in levels B, C and D personal protection and 3 days supervised work on hazardous waste sites undergoing activities similar to those planned as part of this investigation.

<u>Mark R. Walton – Phone Number – (201) 818-6055 Ext.215</u>
Project HSO

<u>Joanne C. Stott – Phone Number – (201) 818-6055 Ext.224 *</u>
On-site HSO

<u>Jennifer L. Potter – Phone Number – (201) 818-6055 Ext.280</u>
Alternate On-site HSO

* - It should be noted that one of the following two cellular telephones will be available for field use. Prior to the implementation of RI activities, parties involved will be informed as to which cellular number is available for use on-site.

- (201) 888-1831
- (201) 888-1826

2.3 FIELD TEAM PERSONNEL

Field team personnel will be responsible for understanding and complying with site health and safety requirements. One member of the project field team will be assigned the responsibility of cleaning and maintaining the personal protective equipment and the decontamination equipment. Field team personnel who will be involved in intrusive activities will have completed the required waste site worker training to comply with 29 CFR, Part 1910.120.

3.0 MEDICAL SURVEILLANCE REQUIREMENTS

Project personnel involved in intrusive activities in the Exclusion Zone will be required to undergo a medical examination prior to, and at the completion of, participation in this project. This examination must take place not more than one year prior to and one year after the completion of site work and must be conducted by a qualified physician.

Components of the medical surveillance program are shown in Table 3-1. The physician must certify whether the individual is fit to conduct work on hazardous waste sites using personal protection, or whether he or she must work within certain restrictions.

Personnel approved to be on-site and who are working under the requirements of this HASP will be required to undergo a repeat medical exam at or before the conclusion of the project to determine possible health impacts from any exposure to high concentrations of hazardous substances. Any person suffering a lost-time injury or illness must have medical approval prior to returning to work on-site.

All medical records will be held by the employer in accordance with OSHA regulations on confidentiality and any other applicable regulations and will be made available to OSHA upon request.

The content and frequency of medical examinations will be established consistent with the Brown and Caldwell contract physician's medical opinion considering pertinent OSHA requirements, site hazards and personnel involved.

TABLE 3-1

COMPONENTS OF MEDICAL SURVEILLANCE[(A)]

- Medical and occupational history

- Physical examination, with particular attention to the cardiopulmonary system, general physical fitness, skin, blood-forming, hepatic, renal, and nervous systems

- Urinanalysis, to include:

  - color
  - appearance
  - specific gravity
  - pH
  - ketones
  - protein
  - glucose
  - bilirubin
  - leukocyte esterase
  - nitrite
  - WBC
  - RBC
  - casts
  - bacteria
  - epithelial cells
  - crystals
  - yeasts
  - heavy metals - cadmium, chromium, lead, mercury

- Blood analysis, to include:

  - complete blood count
  - hemoglobin
  - albumin, globulni, total protein
  - bilirubin - direct and total
  - g-glutamyl transpeptidase
  - serum glutamic oxalacetic transaminase
  - lactic dehydrogenase
  - alkaline phosphatase
  - sodium
  - potassium
  - chloride
  - magnesium
  - calcium
  - phosphorus
  - uric acid

TABLE 3-1 (CONTINUED)

COMPONENTS OF MEDICAL SURVEILLANCE[(A)]

- BUN (blood urea nitrogen)
- creatinine
- cholesterol
- triglycerides
- glucose
- iron

• Pulmonary function test

• Kidney and Liver function test

• Additional tests as appropriate, including but not limited to:

- chest X-ray
- EKG
- Vision
- hearing

(A) Typical medical exam contents - subject to modification by physician opinion.

4.0 TRAINING REQUIREMENTS

All personnel conducting field activities on-site are required to be certified in health and safety practices for hazardous waste operations as specified in the Federal OSHA Regulations (29 CFR 1910.120) (revised March 7, 1996). Paragraph (e) (3) of the above-referenced regulations requires that each employee, at the time of job assignment, receive a minimum of 40 hours of initial instruction off the site, and a minimum of three days of supervised field experience. See Table A-1 for a typical baseline training protocol.

Paragraph (e) (3) of the above referenced regulations requires that on-site management and supervisory personnel directly responsible for, or who supervise employees engaged in hazardous waste operations, must initially receive eight hours of additional specialized training (typical content – Table A-2). Management and supervisory training must emphasize health and safety practices related to managing hazardous waste work.

Paragraph (e)(8) of the above referenced regulations requires that workers and supervisors must receive eight hours of refresher training annually on the items specified in Paragraph (e)(2) and/or (e)(3). (Typical content – Table A-3).

Additionally, personnel involved in the project must receive adequate site-specific training, in the form of an on-site health and safety briefing given by the Project HSO prior to participating in on-site field work, which will involve a review of this HASP with emphasis on site- specific issues. It should be noted that visitors will be required to sign-in and out when access to the Site is desired. Additionally, approved visitors who do not have appropriate training and/or PPE will have limited access to the site during RI activities.

Health and safety meetings will be conducted at the beginning of each day's activities by the On-site HSO and will cover such items as weather conditions, communication procedures, protective clothing and other equipment to be used, potential chemical and physical hazards, emergency procedures, and conditions and activities from the previous day. A cellular phone will be provided to the field team to facilitate immediate communication with corporate and emergency resources (e.g. ambulance, fire department, etc.).

Visitors entering the Exclusion Zone or Contamination Reduction Zone will be required to receive the necessary site-specific training from the On-site HSO, must be equipped with the proper personal protective equipment, and if respiratory protection is required in the exclusion or contamination reduction zone, they will be required to have passed a qualitative fit test within the last year.

5.0 SITE HAZARD EVALUATION

5.1 CHEMICAL HAZARDS

5.1.1 Chromium

The RI activities will generally focus on the investigation of COPR and its related compounds. Cr is a naturally occurring mineral and is ubiquitous in the environment. Inorganic Cr compounds exist in valence states ranging from Cr(-III) to Cr(VI). The principal valence states of health concern are trivalent Cr(III) and hexavalent Cr(VI). Cr(III) is the common stable form found in nature. Cr(VI) is almost exclusively produced as a result of manufacturing processes.

The health effects of the two oxidation states of Cr are different and must be considered separately. Cr(III) is an essential nutrient, and is relatively non-toxic for humans and other mammalian species. Cr(VI) is a strong oxidizer and more toxic than Cr(III) and reacts differently in the environment. Cr can be absorbed by humans, albeit at differing rates, through the respiratory tract, gastrointestinal tract, and skin. The absorption is dependent on the matrix, bioavailability, the chemical valence state, and the molecular form of the Cr. In general, however, neither Cr(VI) (at the expected concentrations) nor Cr(III) is well absorbed.

The health and safety/toxicological characteristics of Cr and Permissible Exposure Limits (PELs) expressed as eight hour time-weighted averages (TWAs) based on 29 CFR, Part 1910.1000, Air Contaminants; Final Rule, June 18, 1998 are presented in Table 5-1. PEL standards are established by OSHA and are based upon available information from industrial experience and animal studies.

5.1.2 Other Chemicals

Based on the available data for Site 116, other hazardous chemicals are known to be present at the site and are likely in direct contact with the COPR, and/or COPR-affected soil. Potential hazards related to specific chemicals known to be present at the site are addressed in Appendix C to this HASP. Health and safety analyses tasks to be performed are in Appendix D. If chemicals, hazardous conditions, or objects potentially bearing materials of unknown identity are encountered, operations will be temporarily halted and the On-site HSO will assess the situation before resuming field activities.

5.2 PHYSICAL HAZARDS

Physical hazards can range from the dangers of tripping and falling on uneven ground to those associated with work in conditions of excess heat or cold. The following are physical hazards which may be encountered during the planned investigation activities at Site 116.

- <u>Tripping Hazards</u> – At Site 116, uneven ground surfaces create a potential tripping hazard in the vicinity of the surface water ditches that cross the site, and along the bank of the Hackensack River. In addition, debris, crevices, and irregular surfaces are present in these and other areas and in the vicinity of the vacant on-site buildings. Extreme caution should be used when walking in, or around, the buildings.

- <u>Cuts and Lacerations</u> - Contact with various machinery such as that used for drilling, excavation, and sampling can result in cuts and lacerations. Additonally, contact with the vacant building surfaces and miscellaneous equipment/debris within and around the buildings creates a potential for cuts and lacerations. Site personnel will be informed generally about such hazards in the daily briefings as well as methods to minimize this exposure, and treat cuts, bruises, and other minor injuries. An American Red Cross approved Emergency Trauma first aid kit will be present in a mobile support unit at the site and available during field activities. The mobile support unit will also include a stretcher, portable eye wash unit and fresh water, as necessary.

- Insect/Animal Bites - Animals and some insects may bite and thereby pose a health hazard in the form of irritation, illness, or poisoning. In an effort to minimize the health hazard associated with insect bites (e.g. Lyme Disease and West Nile Virus), field personnel will equipped with insect repellant. However, insect repellant will only be applied in the support zone on personnel with level D PPE. Anyone bitten should be given immediate first aid, as necessary, and shall be transported to the nearest medical facility. Members of the field crew will be properly briefed regarding the potential for encountering insects and animals on each site.

- Lifting Hazards - Improper lifting by workers is one of the leading causes of industrial injuries. Field workers in the drilling program may be required to lift or move heavy objects (drill casings, auger flights, etc.). Therefore, members of the field crew will be apprised of proper methods of lifting heavy objects. (This is covered in the 40 hour training course.) Workers will be cautioned against lifting objects too heavy for one person.

- Hazards Resulting from Buried Objects - Buried drums, cylinders, fluid or electrical transmission lines, or tanks, if encountered during drilling/excavation activities can pose a health/safety and environmental hazard, particularly if penetrated. If such hazards are encountered, intrusive activities will cease immediately. The situation will be monitored and the On-site HSO will make a determination whether to continue or discontinue intrusive activities (e.g. drilling/excavation) in close proximity to where the buried object was encountered. Efforts will be made to avoid such incidents by conducting appropriate surveys prior to the startup of intrusive activities.

- Utility Hazards - Prior to drilling or excavation activities, the New Jersey One-Call System will be accessed to request a utility mark-out. In accordance with current New Jersey One-Call Requirements, the responsibility to obtain utility mark-outs is that of the person or company conducting the intrusive exploration (i.e., drilling subcontractor). One-Call will no longer accept mark-out requests from oversight representatives such as Brown and Caldwell. Therefore, the confirmation number for the utility mark-out will be obtained by the driller. However, it will be the responsibility of the on-site HSO to obtain this number from the driller prior to conducting any subsurface explorations. The mark-out confirmation number will be recorded in the on-site field log book, along with any site specific information regarding the location(s) of utilities.

  Since the New Jersey One-call system will only mark out utilities on public property (i.e. Belleville Turnpike), the potential for on-site utilities will be assessed by an independent utility mark-out service. In addition, an area inspection will be made to identify subsurface and overhead utilities through visual identification of manholes, pull boxes, valve boxes, utility markers, vent risers, overhead electrical lines, and the like.

- Traffic Hazards - The majority of the investigative activities in the RIWP for this site are located away from public roadways. However, it is conceivable that some RI activities may encroach on Belleville Turnpike. If these activities occur within the right-of-way or the roadway, traffic control devices and flagmen will be employed to protect both the workers and the public. This effort will be coordinated with local authorities.

5.3 TEMPERATURE STRESS

5.3.1 Heat Stress

The combination of high ambient temperature, high humidity, physical exertion, and/or personal protective apparel, which limits the dissipation of body heat and moisture can cause heat stress. The On-site HSO is responsible for monitoring heat stress in the field team personnel.

The following prevention, recognition, and treatment strategies will be implemented to protect personnel from heat stress during the summer months. Personnel will be trained to recognize the symptoms of heat stress, and to apply the appropriate treatment.

A. Prevention

1. Provide Plenty of Liquids - Available in the Support Zones will be ready supplies of potable water or equivalent (e.g., Gatorade).

2. Provide Cooling Devices - A portable, pump-activated sprayer and containers of tap water will be available in the mobile support unit to reduce body temperature, cool protective clothing, and/or act as a quick-drench shower in case of an exposure incident.

3. Adjustment of the Work Schedule - During the hot summer days, labor intensive tasks which pose a high potential risk of heat stress will be performed during the coolest part of the day.

B. Recognition and Treatment

Any person who observes any of the following forms of heat stress, either in themselves or in another worker, will report this information to the On-site HSO immediately after implementing treatment, if possible. Since a common symptom of impending heat stress is disorientation or confusion, the On-site HSO will observe the workers for such symptoms on a routine basis throughout the day.

1. Heat Rash (prickly heat):

   Cause: Continuous exposure to hot and humid air, aggravated by chafing clothing.

   Symptoms: Eruption of red pimples around sweat ducts accompanied by intense itching and tingling.

   Treatment: Remove source of irritation and cool the skin with water or wet cloths.

2. Heat Syncope (fainting):

   Cause: Sun rays beating down on victim's head and prolonged upright position can lead to mild dehydration and contraction of the blood vessels resulting in a temporary deficiency of blood to the brain.

   Symptoms: Brief loss of consciousness.

   Treatment: Worker should lie down and drink 1/2 liter to one liter of fluid (not alcohol). Elevate the legs and cover the head.

3. Heat Cramps (heat prostration):

   Cause: Profuse perspiration accompanied by inadequate replenishment of body water and electrolytes.

   Symptoms: Sudden development of pain and/or muscle spasms in the abdominal region.

   Treatment: Move the worker to the Contamination Reduction Zone. Remove protective clothing. Provide fluids orally. Decrease body temperature and allow a period of rest in a cool location.

4. Heat Exhaustion (heat toxemia, sunstroke):

   Cause: Overexertion in a hot environment and profuse perspiration accompanied by inadequate replenishment of body water and electrolytes. A serious condition.

   Symptoms: Muscular weakness, tiredness, staggering gait, nausea, dizziness, shallow breathing, pale and clammy skin, approximately normal body temperature.

   Treatment: Perform the following while simultaneously making arrangements for transport to a medical facility: Move the worker to the Contamination Reduction Zone. Remove protective clothing. Lie the worker down on his or her back, in a cool place, and raise the feet 6 to 12 inches. Keep warm, but loosen all clothing. If conscious, provide sips of a salt water solution using one teaspoon of salt in 12 ounces of water. Transport the worker to a medical facility.

5. Heat Stroke:

Cause: Same as heat exhaustion. An extremely serious condition.

Symptoms: Dry, red, hot skin, dry mouth, dizziness, nausea, headache, rapid pulse. Temperature continues to rise unless treatment is implemented.

Treatment: The basic principle is to lower the body temperature rapidly.

1. Move the victim out of the sun.
2. Remove clothes.
3. Soak victim completely with water, wet hair as well.
4. Place victim in front of a fan or in a breeze, if possible.
5. If ice is available, apply directly to the victim, especially under the arms and on the head.
6. Monitor body temperature with available thermometers. Temperature should start to decrease within minutes.
7. As temperature approaches 101°F, stop cooling measures and initiate transport to a hospital or declare an emergency response. The temperature should continue to fall, often to subnormal, during this period.

Other considerations in treating heat stroke are:

1. Rub skin briskly during cooling process.
2. If cardiac arrest occurs, perform CPR (ONLY IF CERTIFIED) and continue cooling.
3. If a seizure occurs, continue cooling; the seizure will stop.
4. No drugs of any kind are to be given to the victim.

C. Heat Stress - Predisposing Factors

Preventing heat stress is clearly preferred to treatment. The following factors increase the individual's risk of heat stress:

- Physically unfit
- Age
- Not accustomed to heat
- Sunburn
- Alcohol and drugs
- Dehydration
- Heavy or non-breathable clothing
- Not covering one's head

5.3.2 Cold Stress

Personnel can be susceptible to cold stress while conducting field work during cold weather months. To guard against cold stress and to prevent cold injuries, appropriate warm clothing should be worn, warm shelter must be previously identified and readily available, rest periods should be adjusted as needed, and the physical conditions of on-site field personnel should be closely monitored. Personnel working on-site must be able to recognize the signs and symptoms of cold stress and arrange for first aid by qualified personnel. The On-site HSO is responsible for monitoring the signs and symptoms of cold stress among field personnel.

The development of cold stress and cold injuries is influenced by three factors: the ambient temperature, the velocity of the wind, and the amount of sunshine. Fingers, toes, and ears are the most susceptible parts of the body affected by cold.

A. Frost Nip

Frost nip is the first sign of frost bite and is the only form of local cold injury that can be definitively treated in the field.

Symptoms: A whitened area of the skin which is slightly burning or painful.
Treatment: Simply rewarming the affected part is a definitive treatment.

B. Frost Bite

Local damage is caused by exposure to low temperature environmental conditions. It results at temperatures when ice crystals form, either superficially or deeply, in the fluids and underlying soft tissues of the skin. The nose, cheeks, ears, fingers, and toes are most commonly affected.

Symptoms: Skin is cold, hard, white, and numb. There may also be blisters. The affected parts will feel intensely cold; however, there may not be any pain. The victim may not know that he or she is frost-bitten.

As time goes on, the victim may experience mental confusion and impairment of judgment. The victim may stagger and eyesight may fail. The victim may fall and become unconscious. Shock is evident and breathing may cease. If death occurs, it is usually due to heart failure.

Treatment: Generally, definitive thawing should not ordinarily be performed in the field because, if re-freezing occurs, it could result in severe damage. The victim should be transported to a medical facility after the following measures are instituted:

Do Not:

- Do not walk on a thawed foot or toes or use thawed hands.
- Do not allow victim to smoke or drink alcohol.
- Do not rub affected area with anything.
- Do not break any blisters.
- Do not apply heat of any kind.

Do:

- Do place victim in protected environment.
- Do prevent further heat loss (warmer clothes).
- Do protect from further damage (warm covering).

C. Mild Hypothermia

Symptoms: The single most important sign of mild hypothermia is a change in behavior. Some signs that can be observed are:

- Decrease in work efficiency
- Decreased level of communication
- Forgetfulness
- Poor judgment
- Poor motor skills (difficulty in handling objects, dropping tools)

The target organ of mild hypothermia is the brain. During mild hypothermia, most of the body's protective mechanisms for temperature control are intact. Shivering is usually present and "goose flesh" and pale skin persist. When asked directly, the victim will usually say that he feels cold. A worker impaired by mild hypothermia can be a danger to himself and co-workers.

Treatment:

- The victim should be moved indoors or into a heated vehicle.
- Remove all wet or damp clothing, dry skin, and apply dry clothing.
- The head should be covered with a hat or blanket.
- Blankets should be put on the victim.
- The victim should be given hot fluids (no alcohol).
- If possible, monitor the victim's temperature at 15 minute intervals.

D. Moderate Hypothermia

For field purposes, this may be defined as the stage at which the patient is clearly incapable of functioning effectively, but is conscious.

Symptoms: The victim's body temperature is well below normal and some mental changes may occur which include:

- Disorientation to people, place, and time
- Hallucinations
- Inappropriate laughing or crying
- Bizarre behavior for that individual

During moderate hypothermia, shivering is absent, "goose flesh" disappears, and the heart rate may slow down. The victim does not "feel" cold.

Treatment:

- First, treat the patient for mild hypothermia.
- Administer hot blowers or heaters.
- Use human body heat.
- Watch for signs of returning to normal (e.g., shivering, goose flesh, teeth chattering).
- Monitor mental status.

After these steps are initiated, the victim should be taken to a medical facility. The patient should not return to work for at least 48 hours.

E. Severe Hypothermia:

Symptoms: Characterized by a decrease in the body temperature which results in a deep coma in which even vital signs become very weak and finally undetectable. Most occupational cases occur when the victim is alone or lost.

Treatment:

1. Remove wet clothes, dry skin, and apply dry clothes.
2. Activate rewarming.
3. Prepare to transfer the victim to a medical facility.
4. If the patient is pulseless and is not breathing, perform CPR (ONLY IF CERTIFIED).
5. Very cold victims often tolerate long periods of arrest, even without CPR. The victim must be handled very carefully because of extreme susceptibility to even minor trauma.

5.4 CONFINED SPACES

Potential work activities entailing confined space entry include sampling of catch basins and storm sewers. These activities are not expected to occur as part of this RI. However, should confined space entry become necessary, the HASP of the certified confined space entry contractor will be utilized.

5.5 SURFACE WATER/SEDIMENT SAMPLING

The following procedures address the conduct of sediment and/or surface water sampling (i.e. on the Hackensack River) in fulfillment of the RIWP activities.

5.5.1 Off-ShoreActivities

- Off-shore sediment and/or surface water sampling will be conducted using a small boat (Class A) equipped with an electric or gasoline powered outboard motor. The boat/motor combination will be selected such that is capable of at least twice the speed of the expected surface water current at the time of sampling.

- A minimum of two people (sampling team) is required to be on the boat at all times during sampling activities.

- Each member of the sampling team is required to wear a Coast Guard approved Personal Flotation Device (PFD) while onboard the boat.

- A lifeline attached to a "Type IV throwable device" will be available on the boat in the event that an individual falls overboard, or the boat capsizes.

- Two emergency blankets will be available on the boat for the treatment of hypothermia in the event that an individual falls overboard.

- A portable phone will be available on the boat in the event that an emergency should arise.

5.5.2 On-Shore Activities

- A third individual (observer) will be present on-shore, adjacent to the sampling team, during sampling activities.

- The observer is responsible for maintaining continuous eye contact with the crew in the boat and will act as a liaison between the sampling team and emergency authorities, in the event of an emergency.

- The observer will be provided with a portable phone for emergency use and maintaining contact with the sampling team.

- The observer will be responsible for having the following additional equipment on hand:

    1. A map showing the route to the closest hospital and the appropriate emergency service(s) telephone number(s). Flight for Life contact information will also be available should an emergency occur during rush hour.

    2. Emergency blankets for treatment of hypothermia.

    3. A first aid kit.

    4. Lifeline with Coast Guard approved "throwable flotation device".

5.5.3 Emergency Procedures

- In the event that an individual falls overboard or the boat capsizies, the observer will first call emergency personnel and then make an attempt to get lifelines to the victim(s) and pull him/her/them to shore.

- The observer is not to enter the water.

- If the victim exits the water before the arrival of emergency personnel, the observer will administer first aid as appropriate.

- Other safety considerations for general marine operations are provided in Attachment A from Brown and Caldwell's Health and Safety Manual.

TABLE 5-1
HAZARD CHARACTERISTICS OF CHROMIUM

Note: Bullet items do not correlate line by line.

Substance	Toxicity/Carcinogenicity	Exposure Limits* and IDLH[(2)] Values
Chromium	• Hexavalent compounds have corrosive action on skin and mucous membranes in acute exposures. • Hexavalent compounds are more toxic than trivalent compounds. • High doses of hexavalent chromium compounds received by oral route can promote kidney damage. • Acute hexavalent chromium exposure can affect the nervous system and liver. • Hexavalent chromium is a human respiratory carcinogen at high work-place exposures. • Trivalent chromium, like other compounds, can cause adverse health effects at very high doses or concentrations.	• 0.5 mg/m^3 - Chromium metal, divalent and trivalent chromium compounds, as Cr (TLV); PEL = 1 mg/m^3 • 0.001 mg/m^3 - Hexavalent chromium as Cr (Water soluble and certain water insoluble compounds) • 0.1 mg/m^3 - (Ceiling)[(1)] – Hexavalent Chromium as Chromic acid and chromates • 15 mg/m^3 - Chromic acid and chromates (IDLH)[(2)]

Notes:

* 8-hour Time-Weighted Averages (TWAs) unless otherwise noted.

(1) Ceiling - The exposure that should not be exceeded, typically over any 15 minute period throughout the work shift.

(2) IDLH - Immediately Dangerous to Life and Health according to NIOSH, allowing for 30 minute exposure during escape without irreversible or life threatening effects.

References

"Threshold Limit Values and Biological Exposure Indices for 2001." American Conference of Governmental Industrial Hygienists, Cincinnati, Ohio, 2001.

"Pocket Guide to Chemical Hazards." National Institute for Occupational Safety and Health Publication No. 94-116, Cincinnati, Ohio, June, 1994.

TABLE 5-1 (CONTINUED)
HAZARD CHARACTERISTICS OF CHROMIUM

References (Cont'd)

Lewis, Sr., R.J. Hawley's Condensed Chemical Dictionary, Thirteenth Edition, New York, Van Nostrand Reinhold, 1997.

29 CFR, Part 1910.1000, Air Contaminants; Final Rule, June 18, 1998.

Harbison, Raymond D., Ph. D., et. al. Conclusions of the Expert Review Panel on Chromium Contaminated Soil in Hudson County, New Jersey, Pittsburgh, Industrial Health Foundation, May 1990.

6.0 PERSONAL PROTECTION

The level of personal protection required during the RI at Site 116 will be established by the On-site HSO based on the location of the work, the type of activity, and the field conditions at the time (i.e. temperature, wind, etc). A description of the task-specific levels of personal protective equipment (PPE) is provided in Tables 6-1A through 6-1C. Action levels for upgrading the level of PPE based on airborne contaminants are listed in Table 6-2. However, if prior to, or during, the conduct of RI activities, additional information is revealed that indicates the current level of protection is not adequate, intrusive activities will immediately cease on-site and the level of protection for on-site personnel will be reassessed by the On-site HSO and key project personnel. Further health and safety upgrades may be implemented in the event unknown conditions necessitate.

PPE will be inspected before each use to assure it is in working order. After use, Respirators and PPE will be cleaned in the Contaminant Reduction Zone and kept in a location free from contamination prior to re-use.

All personnel will be trained in the proper use, inspection and maintenance of PPE prior to wearing it. Respirator wearer's will receive a qualitative fit test prior to initial respirator assignment and at least annually thereafter.

PPE will be replaced as necessary based on inspections made during use or at the end of the day. Respirator cartridges will be changed after 8 hour's use or more frequently if breakthrough or excessive breathing resistance is noted.

In the event that airborne contaminant concentrations higher than the action levels for the current PPE level are encountered, all field personnel in the Exclusion Zone shall upgrade to the next higher level of protection. The On-site HSO will contact the Project HSO, Project Manager, and other key project personnel to inform them of this change. If site conditions dictate a higher level of personal protection than Level C at any time, the On-site HSO will instruct field personnel to evacuate the Exclusion Zone initially, and if necessary, the Site, and all intrusive activities will cease. Personnel necessary for continued air monitoring and mitigation of the conditions resulting in the contaminant release (e.g., grouting of a borehole or backfilling of a test pit) will upgrade to Level B before continuing the work. Emergency procedures, if necessary, will be implemented as discussed in Section 10.

Some modification in safety apparel (e.g., switching from poly-Tyvek to standard Tyvek) may be implemented by the On-site HSO in order to balance concerns for full contaminant protection against concerns for heat stress resulting from the need to wear more restrictive protective clothing. Protective equipment which fully complies with the requirements of all the levels of protection listed in Table 6-1 (A-C) will be immediately available at all times on-site.

Level C respiratory protection will normally be provided using NIOSH/MSHA-approved full-face respirators, with combination organic vapors-acid gas/HEPA filter cartridges approved for removal of specific organic vapors, particulates, gases, and fumes. The HEPA filter cartridges will be changed at the end of each work day or when breakthrough occurs, whichever comes first. All team members will be fit-tested for respirators using irritant smoke before starting work on-site.

Air monitoring during field activities for the purpose of defining the proper level of PPE will be conducted throughout the RI activities on-site. The primary purpose of this air monitoring is to (1) assess the adequacy of respiratory protection and (2) assess potential hazards in the work area. When any action level presented in Table 6-2 is exceeded, during field activities (e.g., drilling or excavation operations), the appropriate responses will be immediately implemented. Air monitoring is discussed in further detail in Section 8.0 of this HASP.

TABLE 6-1A

COMPONENTS OF LEVEL D PERSONAL PROTECTION

COMPONENTS

- Safety glasses with side shields (or goggles)
- Hard hat
- Face shield*
- Ordinary coveralls
- Ordinary work gloves
- Steel-toe, steel-shank work shoes or boots
- Disposable outer "booties"

ASSOCIATED WORK ACTIVITIES

- Non-intrusive site reconnaissance in areas other than the lagoon area.
- Performance of non-intrusive geophysical testing, surveying, utility mark-outs in areas other than the lagoon area.

*Optional as necessary

TABLE 6-1B

COMPONENTS OF LEVEL C PERSONAL PROTECTION

COMPONENTS

- Safety glasses with side shields (or goggles)*
- Hard hat
- Face shield*
- Standard Tyvek coveralls
- Inner gloves of snug-fitting latex or vinyl
- Outer gloves of neoprene or nitrile
- Steel-toe, steel-shank work shoes or boots
- Outer boots of neoprene or butyl rubber
- Disposable outer "booties"*
- Full-face air-purifying respirator
- Taping of gloves and boots to Tyvek coveralls
- Two-way radio

ASSOCIATED WORK ACTIVITIES

- Non-intrusive site reconnaissance in the lagoon area.
- Performance of non-intrusive geophysical testing, surveying, utility mark-outs in lagoon area.
- Performance of air monitoring within any exclusion zone.
- Collection of surface soil, surface water, or other surface media (i.e. chip or wipe) samples within any exclusion zone.
- Collection of in-situ subsurface soil, groundwater, or NAPL samples from exclusion zones other than the lagoon area.
- Excavation of test pits or other intrusive activity in exclusion zones other than lagoon area.
- Installation of monitoring wells in exclusion zones other than the lagoon area.
- Groundwater monitoring well sampling in exclusion zones other than the lagoon area.
- Measurement of groundwater levels in existing monitoring wells in exclusion zones, except in the lagoon area exclusion zone.
- Monitoring well inspection, repair, and well abandonment in exclusion zones, except in the lagoon area exclusion zone.
- Collection of surface water and sediment samples from on-site ditches and the Hackensack River.

Notes: Respirator to be fitted with NIOSH/MSHA-approved high efficiency filter (HEPA) combination organic vapor\acid gases respirator cartridges.

PPE level may be downgraded by On-site HSO to Modified Level C (respirator not required) based on air monitoring results, site activity, and field conditions.

* Optional - as necessary

TABLE 6-1C

COMPONENTS OF LEVEL B PERSONAL PROTECTION

COMPONENTS

- Hard hat
- Poly Tyvek (or standard Tyvek) coveralls
- Inner gloves of snug-fitting latex or vinyl
- Outer gloves of neoprene or nitrile
- Steel-toe, steel-shank work shoes or boots (chemical resistant)
- Outer boots of neoprene or butyl rubber
- Disposable outer "booties"
- Self-contained breathing apparatus*
- 5-minute escape bottle
- Two-way radio communications
- Taping of gloves and boots to Tyvek coveralls

ASSOCIATED WORK ACTIVITIES

- Collection of in-situ subsurface soil, groundwater, or NAPL samples from lagoon area.
- Installation of monitoring wells in lagoon area.
- Groundwater monitoring well sampling in lagoon area.
- Excavation of test pits or other intrusive activity in lagoon area.

* Personnel assigned to Site 116 investigation activities in Level B protection shall have completed requisite training and respirator fit test within the prescribed time period prior to initiating site activities.

TABLE 6-2

ACTION LEVELS DURING DRILLING AND EXCAVATION ACTIVITIES[(1)(2)*]

Organic Vapors	Combustibles	Oxygen	Hydrogen Sulfide	Particulates[(3)]	Response (activities inside lagoon area)	Response (activities outside of lagoon area)
0-1 ppm Above Background	0% LEL	19.5-21%	0-1 ppm Above Background	5 mg/m^3 Above Background	• Continue drilling/excavation. • Level C protection. • Continue monitoring every 10 minutes/every sample retrieved.	• Continue drilling/excavation. • Modified Level C protection. • Continue monitoring every 10 minutes/every sample retrieved.
1-5 ppm Above Background	0-10% LEL	19.5-21%	1-10 ppm Above Background	<5 mg/m^3 Above Background	• Continue drilling/excavation. • Level B protection. • Continue monitoring every 10 minutes/every sample retrieved.	• Continue drilling/excavation. • Level C protection. • Continue monitoring every 10 minutes/every sample retrieved.
5-25 ppm Above Background Continuous Reading	10-20% LEL	19.5-21%	>10 ppm Above Background	>5 mg/m^3 Above Background	• Continue drilling/excavation. • Level B protection. • Continuous monitoring for organic vapors at borehole/test pit. • Continuous monitoring for LEL at borehole/test pit. • Continuous 0_2 monitoring at borehole/test pit. • Continuous monitoring for H_2S at borehole/test pit. • Continuous monitoring for particulates.	• Continue drilling/excavation. • Level C or B protection depending on site-specific conditions. • Continuous monitoring for organic vapors at borehole/test pit. • Continuous monitoring for LEL at borehole/test pit. • Continuous 0_2 monitoring at borehole/test pit. • Continuous monitoring for H_2S at borehole/test pit. • Continuous monitoring for particulates.

TABLE 6-2 (CONTINUED)

ACTION LEVELS DURING DRILLING AND EXCAVATION ACTIVITIES[1][2]*

Organic Vapors	Combustibles	Oxygen	Hydrogen Sulfide	Particulates[3]	Response (activities inside lagoon area)	Response (activities outside of lagoon area)
>25 ppm Above Background	>20% LEL	<19.5 or >25%	>10 ppm Above Background	>5 mg/m^3 Above Background	• Discontinue drilling/excavation. • Evacuate Exclusion Zone; shut off all engine ignition sources. • Allow borehole/test pit to vent. • Continuous monitoring for organic vapors at borehole/test pit and 200 feet downwind. • Continuous LEL monitoring in borehole/ test pit, determination made of safe re-entry level. • Continuous O_2 monitoring in borehole/test pit, determination made of safe re-entry level. • Continuous H_2S monitoring in borehole/test pit, determination made of safe re-entry level. • Continuous monitoring for particulates.	• Discontinue drilling/excavation. • Evacuate Exclusion Zone; shut off all engine ignition sources. • Allow borehole/test pit to vent. • Continuous monitoring for organic vapors at borehole/test pit and 200 feet downwind. • Continuous LEL monitoring in borehole/ test pit, determination made of safe re-entry level. • Continuous O_2 monitoring in borehole/test pit, determination made of safe re-entry level. • Continuous H_2S monitoring in borehole/test pit, determination made of safe re-entry level. • Continuous monitoring for particulates.

Notes:

(1)* Air monitoring for action levels during drilling activities will occur in the worker's breathing zone. Readings may be taken in the borehole but will not be used for action levels.

(2) Each action level is independent of all other action levels in determining responses. Therefore, an exceedance in any one column dictates that action be taken in accordance with the responses listed in the far right column.

(3) Particulate levels will be monitored in each active work area and at the perimeter of the active Drilling or Excavation Exclusion Zone and will be averaged over a period of two minutes (if determined to be necessary).

7.0 SITE CONTROL

For the purpose of site control, the lagoon area has been identified as a separate work zone (Exclusion Zone) from the remainder of the site based on the elevated concentrations of 2,3,7,8-Tetrachlorodibenzo dioxin (2,3,7,8-TCDD or Dioxin) and other VOCs and SVOCs present in the soil and groundwater. This work zone warrants an increased level of personal protection as discussed below. The lagoon area Exclusion Zone is shown on Figure 7-1.

7.1 SITE 116 Work Zone (excluding the former lagoon area).

An Exclusion Zone, Contamination Reduction Zone, and Support Zone will be established by the On-site HSO for all subsurface investigative activities. Depending on the nature and expected duration of the activity, these zones will be established with cones and/or caution tape by the On-site HSO.

7.1.1 SITE ACCESS

During the course of on-site work, access into the Contamination Reduction Zone and Exclusion Zone will be controlled. In the event of unauthorized personnel entering an Exclusion Zone or Contamination Reduction Zone, work activities will be halted until such personnel leave the area. A brief description of the work zones follows.

7.1.2 EXCLUSION ZONE

The Exclusion Zone is the area in which intrusive work is being performed and will consist of a clearly marked area around the drilling rig or other equipment and will be moved as the drill rig or backhoe is relocated. In most cases the Exclusion Zone will be equal in radius to the height of the rig around the drilling or excavation operation, or at a point of sample collection. All personnel entering the Exclusion Zone will be required to use the appropriate level of PPE and to carry out proper personal decontamination procedures in the Contamination Reduction Zone when leaving the Exclusion Zone.

7.1.3 CONTAMINATION REDUCTION ZONE

The Contamination Reduction Zone is the area where decontamination takes place. It acts as a transition between the Exclusion Zone and Support Zone. The Contamination Reduction Zone will be located in an area central to the sampling points of a site, with consideration given to minimizing the distance to the actual work site. The Contamination Reduction Zone may be moved periodically to accomplish this objective. All personnel in the Exclusion Zone will be required to pass through the Contaminant Reduction Zone and decontaminate themselves prior to leaving the site. The equipment that will be available in the Contamination Reduction Zone is listed in Table 7-1.

7.1.4 SUPPORT ZONE

The Support Zone is that area outside of the Exclusion and Contaminant Reduction Zones that is used to support the investigative activities. The following equipment is required (as necessary) in the Support Zone: cellular telephone, two-way radios, personal protective equipment, first aid kits, portable emergency eyewash stations, portable sprayers, fire extinguishers, stretcher, sampling equipment, sample containers, drinking water, self contained breathing apparatus (where required), and temporary, self-contained toilet facilities. For some parts of the site, a mobile support unit (van or pick-up) will be sufficient to house the Support Zone equipment.

7.1.5 SITE VISITATION

It is expected that representatives from NJDEP, other regulatory agencies, and entities other than Brown and Caldwell will visit the site during RI activities. All such visitors must meet the requirements of this HASP before entering either the Contamination Reduction Zone or the Exclusion Zone. Visitors other than NJDEP or OSHA will be subject to the additional requirement of having to receive written permission to conduct a site visit. Visitors who wish to enter the Exclusion Zone or Contamination Reduction Zone while RI site activities are in progress will be required to meet OSHA training and medical surveillance requirements under 29 CFR 1910.120 and to supply their own proper protective equipment and pass an irritant smoke respirator fit test, where applicable.

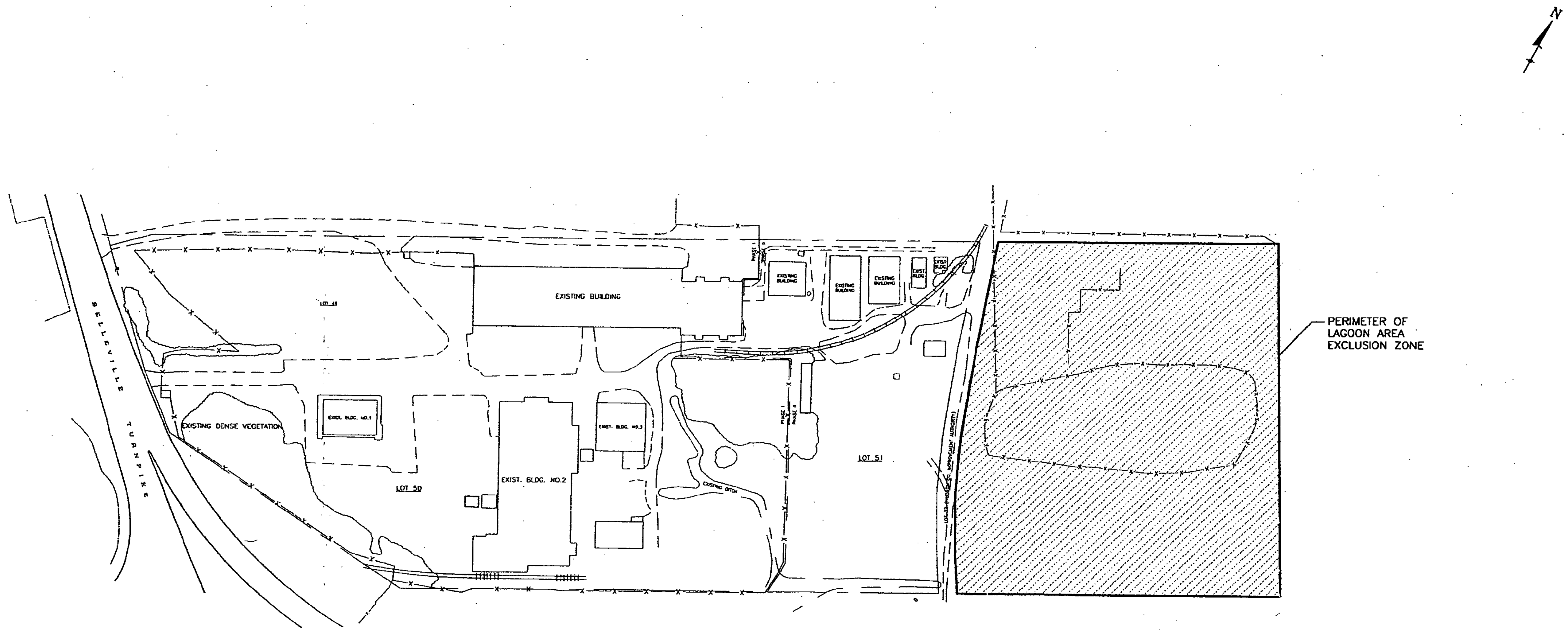
7.2 LAGOON AREA

Due to the presence of elevated levels of Dioxin, VOCs and SVOCs in the vicinity of the lagoons, this entire area will be designated as an Exclusion Zone. This area is shown on Figure 7-1 and is currently surrounded by a fence. During RI activities in this zone (if any), temporary markers will be placed on the fence to clearly identify this area as an Exclusion Zone. A Contamination Reduction Zone will be established by the On-site HSO connecting the Exclusion Zone to the Support Zone as described above for activities within Site 116 proper. The requirements for the Exclusion Zone, Contamination Reduction Zone, and Support Zone described above shall apply to the lagoon Exclusion Zone as well.

TABLE 7-1

SERVICES AND EQUIPMENT TO BE LOCATED IN THE CONTAMINATION REDUCTION ZONES

- polyethylene liner
- 30-gallon tubs (2)
- long-handled brushes
- water and soap (minimum of 250 gallons of potable water)
- 30-gallon garbage cans for disposal of Tyvek suits and gloves (several)
- portable emergency eyewash station
- OSHA approved portable shower
- fire extinguishers (Class A B C and Class D)
- first aid kit
- sand
- large tarp
- sorbent materials, containers, and various hand tools
- air horn
- two-way radio



80 0 80 160
scale feet

LEGEND

LAGOON AREA EXCLUSION ZONE
PROPERTY LINE
RIGHT OF WAY LINE
FENCE LINE
EXISTING STRUCTURE

NO.	REVISIONS	REV'D BY	DATE	APPRO'D BY

BROWN AND CALDWELL
MAHWAH, NEW JERSEY

STANDARD CHLORINE
SITE NO. 116
KEARNY, NEW JERSEY

LAGOON AREA EXCLUSION ZONE

SCALE: AS SHOWN

DRAWN BY	DATE	CHECKED BY	APPROVED BY		DRAWING NUMBER
JHM	6/01	MRW	WGS	–	FIGURE 7-1

RI116-15 06/25/01 PLOT= 1"=80' (RI116-15.PCP)

8.0 AIR MONITORING

Air monitoring will be performed throughout intrusive RI field activities to assess the appropriate level of PPE. Monitoring frequencies will be as summarized in Table 6-2. During RI activities that do not involve intrusive work, air monitoring will be conducted as appropriate. Air monitoring equipment will be calibrated daily and the calibration data will be recorded in the field logbook. Each day, intrusive work will not begin until the instruments are calibrated and background levels are taken and recorded. Breathing zone air and the air space associated with a bore hole, monitoring well, etc. will be monitored for total volatiles with a photoionization detector (HNu Model PI 101 or equivalent). Explosive atmosphere, oxygen content, and hydrogen sulfide content will be monitored with an explosimeter (Gastech Model 1641 or equivalent). Air monitoring results and meteorological data (e.g., temperature range, wind speed, wind direction, etc.) will be recorded in the field logbook.

8.1 TOTAL VOLATILES

8.1.1 Photoionization Detector

During all intrusive activities, air monitoring for total volatiles (organic vapors) will be performed using photoionization detectors (PIDs). Three PIDs (HNu Model PI 101) equipped with 9.5, 10.2 and 11.7 eV lamps will be on-site for this purpose. When readings less than 5 ppm above background in the breathing zone are observed consistently, monitoring will take place at lest every 10 minutes or for every sample retrieved. If readings from 5-25 ppm above background in the breathing zone are observed, and all other air monitoring action levels indicate that drilling or excavation can proceed, monitoring will take place continuously. If organic vapor readings continue to exceed 25 ppm above background in the breathing zone, or other instrument readings continue to necessitate suspension of drilling or excavation, intrusive activities will be halted, the level of protection used by on-site personnel will be reassessed, and an upgrade may be necessary.

8.1.2 Multigas Detector Tubes

Mulitgas Detector Tubes, such as Dräger Tubes or equivalent, shall be used to detect and quantify the concentration of specific contaminants in the air. Based on the known contaminants at Site 116, measurements for benzene shall be taken at a minimum. Additional measurements may be taken based on the levels detected with the HNu. The On-site HSO, in consultation with the Project HSO shall determine the need for additional sampling. These tubes will be used when either a continuous reading on the HNu is recorded, or separate phase product or odorous material is encountered at the borehole or work area. The tubes to be employed must be sensitive in the appropriate PEL range of the compound.

8.2 PARTICULATES

Due to the presence of Dioxin at Site 116, particulate monitoring will be conducted using a portable dust meter during all intrusive activities. The portable dust meter is a handheld device capable of giving real-time readout on the amount of smoke, dust, fumes or mist present in the ambient air. The device is capable of measuring total dust concentrations between 0.01 and 100 mg/m^3. In areas where Dioxin may be present (i.e. the lagoon area), an evaluation shall be conducted to estimate the concentration of Dioxin that may become airborne, and thus, potentially be inhaled by field personnel outside of the Exclusion Zone. Based on this evaluation, modifications to the field activities and/or work zones may be required.

8.3 SUPPLEMENTAL AIR MONITORING

When the On-site HSO, in conjunction with other key project personnel, determines that site conditions require it, air samples will be collected using personal air sampling pumps and will be analyzed using NIOSH Methods 1003 (Halogenated Hydrocarbons) and 1501 (Aromatic Hydrocarbons) or NIOSH Methods 7024 (Chromium and Compounds) and 7600 (Hexavalent Chromium), or both, or other methods will be implemented as required by site conditions and as described in the RI Work Plan. To document potential worker exposure during drilling or excavation, personnel will be fitted with organic vapor dosimeters, if deemed necessary by the On-site HSO.

Personal monitoring will be conducted based on considerations specified in OSHA 1910.120 Section (h). The strategy is based on decisions made by the Project HSO concerning exposure potential considering the tasks to be performed and the chemicals present. The results of personal monitoring will be used to evaluate occupational health control measures and to inform the workers of exposure conditions.

A broad array of sorbent air sampling tubes and associated equipment will also be available in the Support Zone for use by the On-site HSO or other monitoring personnel whenever site conditions indicate a need for further detection and measurement of potentially hazardous gases and vapors. Decisions to conduct personal monitoring shall consider those employees most likely to be exposed based on planned work tasks and duration.

8.4 ACTION LEVELS

Action levels which trigger protective equipment upgrades or work stoppage are based upon chemical substances present and their permissible exposure limits (PELs). For example, benzene has a PEL of 1 ppm and a ceiling limit of 5 ppm. Detection of benzene at 1 ppm triggers air purifying respirator use. Benzene levels above 5 ppm exceed the protection factor of 5 for half-mask respirators and therefore triggers upgrades to full-face air purifying or level B respirators. Similar actions, including work stoppage, are taken for other hazards (e.g., flammable materials present at greater than 10% of the lower explosive limit). Table 6-2 lists default action levels. Specific hazards other than Cr and appropriate action levels are presented in Appendix C.

8.5 WORK STOPPAGE RESPONSES

The following responses will be initiated whenever one or more of the action levels necessitating a work stoppage is exceeded:

1 The On-site HSO will be consulted immediately and, if necessary, the Project HSO will be consulted.

2 Personnel (except as necessary for continued monitoring and contaminant mitigation, if applicable) will be cleared from the work area (e.g., from within the Exclusion Zone).

3 Monitoring will be continued until intrusive work resumes or the source of the contaminant release has been mitigated (e.g., the soil boring is grouted or the excavation is backfilled).

4 If, during drilling or excavation activities, downwind monitoring PID readings are greater than 5 ppm above background for more than one half hour, the soil boring will be grouted or covered with an empty 55 gallon drum until grouting can safely be completed, or the excavation can be backfilled. It should be noted that if particulate levels are encountered above 5 mg/m^3, work will cease until upgrades in PPE are complete (refer to Table 6-2). Continuous monitoring for

particulates will be performed until particulate concentrations fall below 5 mg/m^3.

Chemical releases to air, water, or soil must be reported to the On-site HSO at once. Similarly, exposures resulting from protective equipment failure must be immediately reported to the On-site HSO and to the Project HSO, in writing, within 24 hours.

8.6 CALIBRATION OF AIR MONITORING EQUIPMENT

A. Photoionization Detector: The photoionization detector will be calibrated to a benzene surrogate daily (prior to field activities) and the results will be recorded in the field logbook.

B. Explosimeter: Once a day the explosimeter will be check calibrated to a methane gas standard. Prior to each use, the oxygen sensor will be air-calibrated at an upwind location. This calibration involves adjusting the meter to read 20.5%, the concentration of oxygen in ambient air.

C. Portable Dust Meter: The portable dust meter is self calibrating and fully automatic. Operation should be in accordance with the manufacturer's instructions.

8.7 OFF-SITE AIR MONITORING

Off-site air monitoring will not be performed during the activities proposed in the RIWP. Although Dioxin is present in some of the on-site soils, there are no planned intrusive activities that have the potential to generate significant amounts of dust. The majority of the intrusive sampling activities will be accomplished using the GeoProbe® sampler, which does not bring drill cuttings to the surface. If other drilling techniques are used, such as hollow stem augers, efforts will be made to keep the drill cuttings moist such that dust is not generated. The need for off-site air monitoring shall be re-evaluated if additional activities that have the potential to generate dust are added to the scope of the investigation.

9.0 DECONTAMINATION OF PERSONNEL

Decontamination of personnel will be based on the USEPA-approved decontamination procedures presented in Appendix B and will take place in the Contamination Reduction Zone located on-site in an area central to the sampling points of the site. Equipment decontamination is covered in the Equipment Decontamination Plan.

Personnel performing intrusive tasks (e.g., drilling, excavation, environmental sampling) will be advised that all clothing worn under protective clothing (i.e., underwear, shirts, socks, trousers) should be laundered separately from street clothing before re-wearing. If protective clothing is breached and personal clothing becomes contaminated, the personal clothing will be disposed of in accordance with Section 6.0 of the SIPP (July 2001).

Depending on the PPE level worn (i.e. dependent on type of activity and location on-site; refer to Tables 6-1a through 6-1b), shower facilities may not be provided on-site. In these situations, personnel will be instructed to take a shower daily upon returning to their place of residence. Personnel involved with intrusive activities within the Lagoon Area Exclusion Zone will be decontaminated prior to leaving the Site.

Contaminated equipment and disposable protective equipment (i.e. gloves, booties, and overalls) that cannot be fully decontaminated will be placed in clearly marked containers and retained on-site for future sampling and disposal, as appropriate.

10.0 EMERGENCY PROCEDURES

Incidents during RI activities for which emergency measures might be required are:

- Impending dangerous weather conditions (e.g., thunderstorm, lightning)
- An exposure-related or a non-exposure related worker illness
- A sudden release of hazardous gases/vapors
- An explosion or fire
- A heavy equipment-related accident, or other accident resulting in personal injury
- Slipping, tripping, or falling resulting in personal injury
- Spill of contaminated liquid or solid

Emergency procedures to respond to these incidents are presented below.

10.1 COMMUNICATIONS

Communications will be centered in the mobile support unit which will contain a telephone for direct outside communications with emergency response organizations. The mobile support unit will also contain two-way radios for contact with personnel working on-site. The On-site HSO will carry a two-way radio at all times when away from the mobile support unit. A two-way radio will be maintained at each drill rig and with any other field teams who are performing tasks on-site (e.g., environmental sampling). Work in the Exclusion Zone will only be performed with at least two people in the Exclusion Zone, and a third person maintaining "line of site" control from outside the Exclusion Zone, if possible, or in the mobile support unit. A two-way radio will be maintained in the Contamination Reduction Zone(s) during all decontamination procedures.

10.2 ESCAPE ROUTES

Flags will be positioned near drill rigs and excavation equipment to indicate wind direction. In the event of a sudden release of hazardous gases, or a fire, all personnel will evacuate upwind or at 90 degrees from the location of the release or fire. This may require personnel to move from the Exclusion Zone directly into an offsite area without proper decontamination. At the conclusion of the emergency, they should move to the Contamination Reduction Zone for proper decontamination.

10.3 EVACUATION SIGNAL

In the event of a worker illness, sudden release, fire, explosion, or similar occurrence requiring immediate evacuation of the site, three quick blasts will be sounded on an air horn. The air horns will be kept in a conspicuous place for quick access by personnel in each Exclusion Zone and will be carried by each field team performing tasks on-site. Anyone sounding an air horn will also contact the mobile support unit via the two-way radio to report the incident and request necessary aid. NJDEP and the Brown and Caldwell Project HSO will be notified expeditiously by telephone, and by a written report within 24 hours whenever a site evacuation is executed.

The field team leader will make contact with a site owner/operator representative, as appropriate, to ascertain the signals/system used, if any, for such emergencies as facility evacuation, fire alarm, etc. before initiating RI activities at the site.

10.4 OTHER SIGNALS

Emergency hand signals for use by personnel wearing air-purifying respirators or self contained breathing apparatus are summarized in Table 10-1.

10.5 FIRE/EXPLOSION

At the startup of RI field work, the Kearny Fire Department will be notified and briefed about the potential hazards at the site. The Project HSO will be responsible for this notification. The On-site HSO will keep the fire department informed, as appropriate, as to which areas intrusive activities are taking place. It will be the responsibility of the drilling rig operator to have a fire extinguisher available at each drilling rig location. The drilling rig operator will have the further responsibility of taking fire prevention measures, such as the continuous removal from the drill rig of accumulated oil, grease, or other combustible materials.

In the event of a heavy equipment fire or other fire that cannot be controlled with available equipment, or in the event of an explosion, the local fire department will be summoned immediately by the On-site HSO who shall apprise them of the situation upon arrival. (See Table 10-2 for telephone numbers of emergency response agencies). If firefighters should have to enter the Exclusion Zone, decontamination will be required upon leaving.

10.6 FIRST AID

At the startup of project field activities, the Project HSO will contact personnel in charge of the Emergency Department at West Hudson Hospital in Kearny, New Jersey, regarding the potential hazards at the site. Chemical fact sheets will be provided to the hospitals for known contaminants at the site which pose the most significant health risks (See Appendix C).

First aid for personal injuries will be administered at the mobile support unit by the On-site HSO. Upon the occurrence of an emergency, employees will be decontaminated in accordance with procedures in Section 10.7.1. Workers in need of further treatment will be transported to the hospital as soon as possible. Each on-site vehicle will carry written directions and maps from the site to the hospital (See Figure 10-1). If an injury is serious, and special treatment is required before transport to the hospital, an ambulance will be summoned by the On-site HSO. In case of large traffic backups, the "Flight For Life" located at the University Hospital, University of Medicine and Dentistry of New Jersey, Newark, New Jersey will be contacted.

The appropriate rescue equipment will be maintained in the mobile support unit and will be immediately available. The rescue equipment includes items such as self contained breathing apparatus, safety harness and lines, and a stretcher.

10.7 EMERGENCY ASSISTANCE

The names, telephone numbers, and locations of police, fire, hospital, and other agencies whose services might be required, or from whom information might be needed, will be posted near the telephone in the field office and in the mobile support unit. This list is presented in Table 10-2.

If an ambulance is called to the site, it is preferable to move the injured person, into the Support Zone or off-site to meet the ambulance, if possible. If a head, neck, back, or spinal injury is suspected or the person is unconscious for any reason, the injured person will not be moved and an ambulance will be summoned to the site. If medical personnel have to come into the Exclusion Zone, they will be given the minimum essential amount of protective equipment necessary to ensure their safety while providing medical attention and they will be directed to the victim by the On-site HSO. If circumstances permit, proper decontamination procedures will be followed upon leaving the Exclusion Zone.

Personnel familiar with the emergency will accompany the victim to the hospital, as appropriate.

10.7.1 Decontamination Procedures - Emergencies

In the event of a serious personal injury or illness requiring off-site medical attention, the injured person may first be moved to the Contamination Reduction Zone, where an attempt will be made to go through the decontamination procedures if appropriate, including removal of protective clothing. If the victim cannot be decontaminated, he/she should be wrapped, as appropriate, in coverings to reduce contamination of other personnel. If it should be necessary to transport the injured person directly from the Exclusion Zone to the hospital, the transporting vehicle will, if possible, be decontaminated before leaving the site. If the injury is life-threatening, however, decontamination will be of secondary importance, and the injured party will be taken directly to the hospital without vehicle decontamination. If a head, neck, back, or spinal injury is suspected, the injured person will not be moved and an ambulance or flight for life helicopter will be summoned to the site. Under such circumstances the On-site HSO or other project team member, as appropriate, will communicate to emergency response personnel the nature of the potential contaminants of concern that may be on the protective clothing of the victim so that measures can be taken by the emergency response personnel to mitigate the potential exposure of themselves and/or others to such contaminants.

10.7.2 Site Control During Emergencies

Upon the occurrence of any fire, release of chemical or dramatic accident as a result of site activities, the On-site HSO will be immediately consulted. Based on the judgment of the On-site HSO and chemical release criteria in this HASP, site activities may be halted and emergency response procedures initiated.

The emergency response actions will consist of employee notification, work stoppage, evacuation of the site, notification of off-site responders and isolation of the site until off-site emergency agencies have arrived. Control of site access will be transferred to off-site emergency responding agencies in accordance with Sections 7.1.1 and 7.1.5.

10.8 SPILLS

Potentially contaminated drill cuttings, as well as drilling fluids and well development water, will be containerized and transported between on-site sample locations until the containers are full (allowing air space for thermal expansion of compressible materials), and will be stored on-site prior to disposal according to procedures in the SIPP – Section 6.0. In the event that residual materials are spilled during on-site transport, the following procedures will be implemented:

10.8.1 Liquid Spills

If a DNAPL contaminated liquid (decontamination water, well development water, etc.) is spilled on a permeable surface, two inches of surficial soil or stone will be removed where the spill occurred and the soil or stone will be drummed. Decisions to remove more stone or soil will be based on an on-site inspection and observation by the Project Director or On-site HSO. The area will later be either backfilled with clean soil or stone will be regraded. If DNAPL contaminated liquid is spilled on an impermeable surface, a sorbent material will be applied to the spill area. The sorbent material will be swept up and drummed, and the spill area washed down with clean water and containerized as necessary. The drummed material will be sampled, analyzed, and disposed in the same manner as drill cuttings as detailed in the SIPP - Section 6.0.

10.8.2 Soil Spills

Soil spilled on a permeable surface will be shoveled back into the drum, and the top two inches of soil or stone where the spill occurred will also be removed and drummed. The area will then be either backfilled with clean soil or stone as appropriate, or will be regraded. If soil is spilled on an impermeable surface, the material will be shoveled (or swept) back into the drum, and the area washed with clean water (only outside the lagoon area) and containerized as necessary.

10.9 CONTACT WITH LOCAL AGENCIES

Prior to on-site work, the Project HSO will inform the Kearny Department of Health of the impending remedial investigation. The local hospital(s), police, and fire department(s) will be notified when RI field work is to be conducted.

10.10 ACCIDENT INVESTIGATIONS AND REPORTING

All accidents will be reported to the On-site HSO who will report the accident to the Project HSO, Project Director, and other key project personnel within 24 hours. The On-site HSO will prepare Accident Report Forms to be sent to the Project HSO within 24 hours. Once notified of an accident, the On-site HSO will contact the NJDEP and the Kearny Department of Health, if necessary.

- Accident Investigations: All accidents requiring first aid which occur during work activities on-site will be investigated. The investigation format will be as follows:

- Interviews with witnesses, victims, coworkers.

- Pictures, if applicable, and

- Necessary actions to alleviate the problem.

- Accident Reports: In the event that an accident or some other incident such as an explosion or exposure to chemicals occurs during the course of the project, the On-site HSO will telephone the Project HSO expeditiously and file a written notification within 24 hours. The report will include the following items:

- Name, telephone number, and location of employee involved.
- Name and title of person(s) reporting.
- Date and time of accident/incident.
- Location of accident/incident.
- Brief summary of accident/incident giving pertinent details including type of activity ongoing at the time of the accident/incident.
- Cause or potential cause of accident/incident.
- Casualties (fatalities, disabling injuries).
- Details of any existing chemical hazard or contamination.
- Estimated property damage, if applicable.
- Action taken and/or recommended to minimize recurrence of the incident through application of generally accepted industry safety and security procedures.

10.11 FORMAL REVIEW OF EMERGENCY RESPONSE - ACTIONS

A formal report will be prepared upon completion of an emergency response event. The report will review the event and provide critical analysis of the response actions to identify opportunities for improved response in the future.

TABLE 10-1

EMERGENCY HAND SIGNALS

• Hand gripping throat	Can't breathe
• Grip partner's wrist, or place both hands around wrist	Leave area immediately, no debate
• Hands on top of head	Need assistance
• Thumbs up	I am all right, OK, I understand
• Pointing to one's ear	I can't hear you
• Thumbs down	No, negative

TABLE 10-2

EMERGENCY CONTACTS

Chemical Land Holdings, Inc.	
Mark Harris (Project Contact)	1-972-691-8338
Brown and Caldwell	
William G. Soukup (Project Director)	1-201-818-6055 ext. 212
Mark R. Walton (Project HSO)	1-201-818-6055 ext. 215
Joanne C. Stott (On-site HSO)	1-201-818-6055 ext. 224
Jennifer L. Potter (On-site HSO Alternate)	1-201-818-6055 ext. 280
Emergency Response Agencies	
Kearny Fire Department 109 Midland Avenue Kearny, New Jersey	1-201-991-1400
Kearny Police Department 402 Kearny Avenue Kearny, New Jersey	1-201-998-1313
New Jersey State Police (Emergency Management)	1-609-882-2000
Medical Facilities	
West Hudson Hospital 206 Bergen Avenue Kearny, New Jersey	General- 1-201-955-7000 Emergency- 1-201-955-7040
Ambulance Services	
Kearny Volunteer Emergency Squad (For transport to West Hudson Hospital in Kearny)	1-201-997-7500
Flight For Life (Helicopter Service) (Services Jersey City, Newark, and Kearny)	1-201-456-7000
Environmental and Health Agencies	
NJDEP Hotline (Emergencies, Spills)	1-877-WARN-DEP
Kearny Department of Health	1-201-997-0600
New Jersey Department of Health	1-201-795-6040
USEPA National Response Center (Chemical spills, oil spills, pollutant discharges)	1-800-424-8802
USEPA Region II	1-201-321-6650

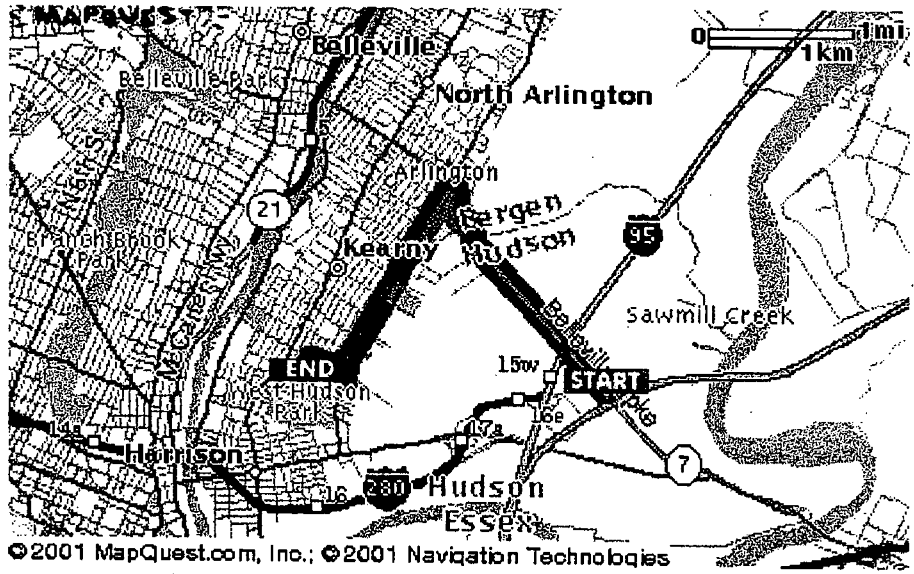
TABLE 10-2 (CONTINUED)

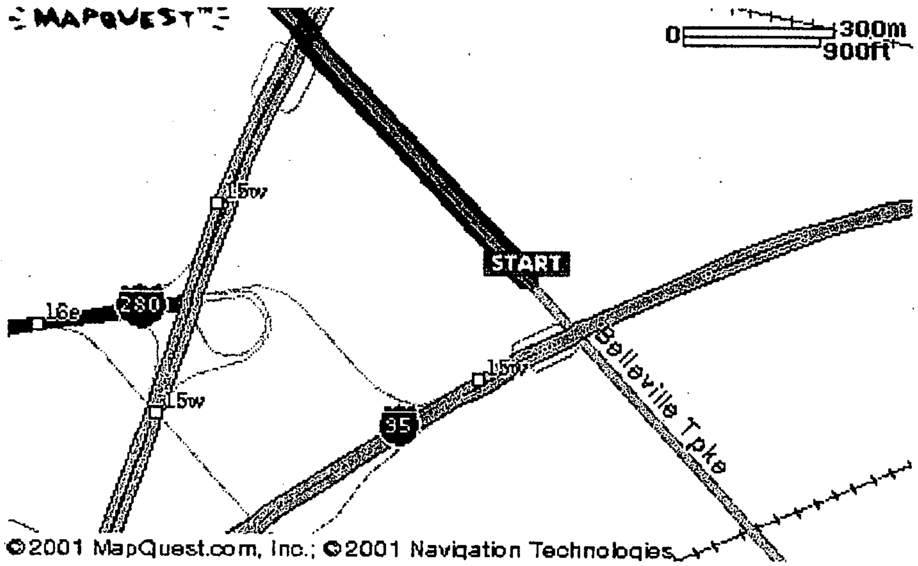
EMERGENCY CONTACTS

Utilities

New Jersey One-Call Service	1-800-272-1000
Kearny Water Company (Water Mains and Sewers)	1-201-991-2700
New Jersey Department of Transportation (Emergencies - 8:30 AM to 4:30 PM weekdays) (Emergencies - 4:30 PM to 8:30 AM weekdays, Saturdays, Sundays, Holidays)	1-201-648-2550 1-609-530-2282
New Jersey Transit Authority	1-800-772-3606

H





WRITTEN DIRECTIONS

- From site turn right onto Belleville Turnpike
- Turn left onto Schuyler Avenue
- Turn right onto Bergen Avenue
- West Hudson Hospital is on the left

FIGURE 10-1

ROUTE TO HOSPITAL

STANDARD CHLORINE SITE 116
KEARNY, NEW JERSEY

BROWN AND CALDWELL

APPENDIX A

WASTE SITE WORKER TRAINING PROGRAMS

TABLE A-1

WASTE SITE WORKER TRAINING PROGRAM (40 HOURS)*

Introduction to Program
Sources of Reference
Hazardous Waste Operations and Emergency Response (29 CFR 1910.120)
Heat Stress/Cold Exposure
Chemical & Physical Hazards
Chemical Protective Clothing (CPC)

Toxicology
Respiratory Protection Principles
Air-Purifying Respirators (APR)
APR Inspection, Donning, and Doffing
Self Contained Breathing Apparatus (SCBA)
SCBA Checkout
SCBA Field Exercise
Review of SCBA Lab and Field Exercise
Implementation of Site Health and Safety Plans
Air-Line Respirators (ALR)

Site Safety
Site Control
Decontamination
Air Monitoring Equipment
Permit Required Confined Spaces (29 CFR 1910.146)
Entry Permit Development
Confined Space Entry
Review of Confined Space Lab and Field Exercise
Material Handling and Spill Containment

Health and Safety Plans (HASP)
Emergency Response Plans (ERP)
HASP & ERP Development

Level A/B Field Exercise
Level B/C Field Exercise
Air Monitoring Equipment Lab
SCBA Proficiency Checkout

Review of Lab & Field Exercises
Review of Air Monitoring Equipment Lab
Medical Monitoring
Hazard Communication (29 CFR 1910.120)
Risk Assessment
APR Fit Test Demonstration and Certification
Written Test

* Typical Content - For Example Only

TABLE A-2

WASTE SITE WORKER SUPERVISORY TRAINING PROGRAM (8 HOURS)*

Recordkeeping Requirements Under Standard 29 CFR 1910.120
OSHA Inspections
Establishing Community Relations
Employee Training and Motivation
Management Traits
Dermal Protection Program
Respiratory Protection Program
Preventative Heat Stress and Cold Exposure Management
Medical Monitoring Requirements
Reporting and Recording Occupational Injuries, Illnesses, and Exposures
Accident Prevention
Spill Containment Program
Permit Required Confined Spaces (29 CFR 1910.146)
Determining the Effectiveness of Decontamination Procedures
Implementation of Site Health and Safety Plans
Implementation of Emergency Response Plans
Implementation of the Hazard Communication Standard (29 CFR 1910.120)
Responsibilities of the Site Safety and Health Supervisor and Project Manager
Personnel Sampling
Interpretation of Air Monitoring Data

* Typical Content - for example only

TABLE A-3

WASTE SITE WORKER ANNUAL REFRESHER TRAINING PROGRAM (8 HOURS)*

OSHA Requirements
Hazardous Wastes
Toxicology
Exposure Limits
Chemical Hazards
Temperature Stress
Other Physical Hazards
Radiation
Site Control at Hazardous Waste Sites
Decontamination Procedures
Personal Protective Equipment
Confined Spaces
Air Monitoring Equipment
Field Exercises

* Typical Content - for example only

APPENDIX B

PERSONNEL DECONTAMINATION PROCEDURES

APPENDIX B

PERSONNEL DECONTAMINATION PROCEDURES

I. Level D Decontamination

Station 1
- Scrub outer boots and gloves with soap and water.
- Equipment - 30 gallon tub
  soapy water
  long handle brush

Station 2
- Rinse off soapy water from boots and gloves with clean water.
- Equipment - 30 gallon tub
  clean water
  long handle brush

Station 3
- Remove outer gloves and deposit in container, if disposable, or store in decon zone for later use.
- Equipment - garbage can with plastic liner

Station 4
- Wash hands and face.
- Equipment - clean water
  soap
  basins or buckets
  small table
  towels

II. Level C Decontamination

Station 1
- Deposit equipment used on-site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths or in different designated containers with plastic liners.
- Equipment: various size designated containers
  plastic liners
  plastic drop cloths

Station 2

- Scrub outer boots and gloves with decon solution or detergent/water.
- Equipment - container (20-30 gallons)
  decon solution or detergent/water
  long handle, soft bristle scrub brushes

Station 3

- Rinse off decon solution from Station 2 using copious amounts of water. Repeat as many times as necessary.
- Equipment - container (30-50 gallons) or spray unit
  clean water
  long handle, soft bristle scrub brushes

Station 4

- Remove tape around boots and gloves and deposit in container with plastic liner.
- Equipment - container (20-30 gallons)
  plastic liners

Station 5

- Remove boot covers and deposit in container with plastic liner.
- Equipment - container (30-50 gallons)
  plastic liners
  bench or stool

Station 6

- Remove outer gloves and deposit in container with plastic liner.
- Equipment - container (20-30 gallons)
  plastic liners

Station 7

- With assistance of helper, remove disposable suit. Deposit in container with plastic liner.
- Equipment - container (30-50 gallons)
  bench or stool
  liner

Station 8

- Remove facepiece. Avoid touching face with gloves. Wash respirator with spray cleaner and paper towels, and store in plastic liner.
- Equipment - spray cleaner
  paper towels
  plastic liners

Station 9

- Remove inner gloves and deposit in container with plastic liner.
- Equipment - container (20-30 gallons)
  plastic liners

Station 10

- Wash hands and face.
- Equipment - clean water
  soap
  basins or buckets
  small table
  towels

III. Level B Decontamination

Station 1 - Segregated equipment drop: Deposit equipment used on-site (tools, sampling devices, containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths or in different containers with plastic liners. Each will be contaminated to a different degree. Segregation at the drop station reduces the possibility of cross-contamination.

Equipment - various size containers
plastic liners
plastic drop cloths

Station 2 - Boot cover and glove wash: Scrub outer boot covers and gloves with decon solution or detergent/water.

Equipment - 30 gallon tub
decon solution or detergent/water
2-3 long handle, soft bristle scrub brushes

Station 3 - Boot cover and glove rinse: Rinse off decon solution from Station 2 using copious amount of water. Repeat as many times as necessary.

Equipment - 30 gallon tub
spray unit
clean water
2-3 long handle, soft bristle scrub brushes

Station 4 - Tape removal: Remove tape around boots and gloves and deposit in container with plastic liner.

Equipment - 30 gallon garbage can
plastic liners

Station 5 - Boot cover removal: Remove boot covers and deposit in container with plastic liner.

Equipment - container (30-50 gallons)
plastic liners
bench or stool

Station 6 - Outer glove removal: Remove outer gloves and deposit in container with plastic liner.

Equipment – container (30-50 gallons)
plastic liners

Station 7 - Suit/safety boot wash: Scrub splash suit and boots with decon solution or detergent/water. Wrap SCBA regulator with plastic to keep water out. Wash escape bottle with sponges or cloth.

Equipment - 30 gallon tub
decon solution or detergent/water
2-3 long handle, soft bristle scrub brushes
sponges or cloths
plastic bags, medium size

Station 8 - Suit/safety boot rinse: Rinse off decon solution from Station 7 using copious amount of water. Repeat as many times as necessary.

Equipment - 30 gallon tub
spray unit
clean water
small buckets
2-3 long handle, soft bristle scrub brushes
sponge or cloths

Station 9 - Safety boot removal: Remove safety boots and deposit in container with plastic liner.

Equipment - 30 gallon garbage can
plastic liners
bench or stool
boot jack

Station 10 - SCBA hip air removal: While still wearing respirator, disconnect air supply hose at regulator and breathing tube at regulator. Remove hip air harness and tank, place on table.

Equipment - table

Station 11 - Splash suit removal: With assistance of helper, remove splash suit. Deposit in container with plastic liner.

Equipment - 30 gallon garbage can plastic liners bench or stool

Station 12 - Inner glove wash: Wash inner gloves with decon solution or detergent/water. Repeat as many times as necessary.

Equipment - bucket
decon solution or detergent/water
small table

Station 13 - Inner glove rinse: Rinse inner gloves with water. Repeat as many times as necessary.

Equipment - bucket
clean water
small table

Station 14 - Facepiece removal: Remove facepiece. Avoid touching face with gloves. Deposit in container with plastic liner.

Equipment - 30 gallon containers
plastic liners

Station 15 - Inner glove removal: Remove inner gloves and deposit in container with plastic liner.

Equipment - 30 gallon garbage can
plastic liners

Station 16 - Inner clothing removal: Remove clothing soaked with perspiration. Place in plastic bag.

Equipment - plastic bags, medium size

Station 17 - Field wash: Wash hands and face.

Equipment - clean water soap basins or buckets small table towels

APPENDIX C

CHEMICAL HAZARDS ON-SITE

APPENDIX C

KNOWN CHEMICAL HAZARDS AT SITE 116

Chemicals	Air Monitoring Action Level
Benzene Chlorobenzene Dichlorobenzene isomers (1,2-; 1,3-; 1,4-) Trichlorobenzene isomers (1,2,3-; 1,2,4;) 2,3,7,8-TCDD (Dioxin) Naphthalene 2,4-Dimethyphenol Pyrene Phenol Trichloroethylene Toluene Ethylbenzene Tetrachloroethylene Butylbenzene O, m, p xylenes Cr(VI) Cr(III)	Volatiles: 1-5 ppm, check for benzene >5 ppm, upgrade to Level C >25 ppm, upgrade to Level B If benzene present: >1 ppm, upgrade to Level C >5 ppm, upgrade to Level B Dusts: Lagoon area: 5 mg/m^3 above background, upgrade Level C

Note: Columns do not match across table.

APPENDIX D

HEALTH AND SAFETY TASK ANALYSES

APPENDIX D
HEALTH AND SAFETY
TASK ANALYSIS

DRILLING

1 Work around heavy equipment has potential for trauma due to contact with overhead objects, cables etc. Minimum protection from these hazards includes safety shoes, hard hats and safety glasses.

2 Special precautions may be necessary to provide the drilling is performed in an area free of underground objects including power or gas lines (generally less than 4 feet deep). Precautionary measures include a thorough review of plans and careful siting of the rig. Surveys using metal detectors (or equivalent) may be necessary.

3 Care must be taken in the positioning of drilling and or other heavy equipment such that it is stable and does not block emergency access or site evacuation routes.

4 Equipment operators and field personnel should be familiar with the proper selection and operation of fire extinguishing equipment. Fully charged and inspected fire extinguishers should be immediately available at the drilling site. Contingency plans should be adopted to provide safe and timely evacuation and recruitment of outside assistance.

5 Field service personnel should be alert to the potential for exposure to noise levels in excess of 90 dBA. Hearing protection should be available if work patterns will require sustained exposure (> 1 hour) to excessive noise.

6 NIOSH has recently declared that diesel exhaust fumes should be considered carcinogenic. Unnecessary exposure to diesel exhaust fumes should be avoided by positioning (upwind, etc.) or respiratory protection (organic vapor cartridges with filters for dust and mist) where avoidance of exposure is impossible.

7 Appropriate emergency and backup personnel should remain in immediate access to the drilling or sampling activity where practical.

8. Drilling operators are to be responsible for the safety of their rigs. This includes avoidance of overhead obstructions (e.g., electrical lines), maintaining the proper grounding on set up, support (e.g., blocks and guy wires), installation guards, inspection of wire, rope, etc.

9 On finished wells, covers equipped with vent plugs should be securely install over the open well casing.

APPENDIX D (CONTINUED)
HEALTH AND SAFETY
TASK ANALYSIS

10 The drill rig operator will practice fire prevention measures, including periodic cleaning of the drill rig to remove combustible/flammable residues (oil, grease, etc.).

11 Exposure to soil and water contaminants is possible during drilling and well development activities. Hazards and protective measures including exposure monitoring and personal protective equipment are selected based on a review of site specific hazards as outlined in this HASP and associated RIWP.

APPENDIX D (CONTINUED)
HEALTH AND SAFETY
TASK ANALYSIS

FIELD SAFETY

1 Field Service personnel should maintain communications with their office counterparts. Periodic phone calls may be warranted to provide no mishaps have occurred.

2 During initial site characterization potential hazards arising from unstable topography, presence of water, construction debris, plants, insects or animals should be identified and measures taken to avoid them.

3 Access to remote locations warrants careful consideration of protective clothing and/or first aid supplies to prevent and/or address insect or animal bites/stings etc. Proper first aid supplies and use of a buddy system are especially important for employees who have known allergies. Site personnel requiring immediate access to special first aid supplies (e.g., prescription drugs for allergies), shall be responsible for obtaining and arranging for administration of these medications as prescribed by their physician.

4 Site personnel will be expected to adhere to the plant or facility safety and health rules, as appropriate, in addition to the health and safety plan for the project. Where there are conflicts between the facility rules and the health and safety plan, the project manager and site health and safety officer should be contacted for resolution of inconsistencies. Wherever possible, the facility's health and safety rules and the HASP should be reviewed prior to site access to identify and resolve any conflicts.

APPENDIX D (CONTINUED)
HEALTH AND SAFETY
TASK ANALYSIS

SOIL AND WATER SAMPLING

Collection of soil, waste water and/or other environmental samples at hazardous waste sites presents a variety of potential health and safety hazards, many of which are due to the use of required equipment decontamination agents to provide appropriate quality control. Health and safety concerns due to potential hazards posed by the particular work site under investigation are addressed by the formal health and safety plan for that site. The following are key health and safety issues and recommended practices for field work involving sample collection at any work site. They address concerns posed by work activities necessary as part of proper sample collection techniques and quality assurance practices.

1 Protection from skin contact with soil, water or waste borne chemicals requires the selection and use of garments and protective coverings that will stop the chemicals in question and will not degrade upon chemical contact. This is especially important for highly concentrated chemicals (e.g., free product, concentrated wastes and decontamination chemicals).

   A Thin, disposable latex or vinyl gloves are not designed to prevent entry of or withstand prolonged contact with many chemicals that are being sampled or chemicals used to decontaminate sampling equipment. These gloves are used primarily for quality control purposes as part of sample collection techniques.

   B Where protection is necessary to prevent skin contact with suspect contaminants, the protective coverings should be worn <u>under</u> outer disposable gloves used for quality control purposes. This may require the use of large or extra large disposable gloves to accommodate inner coverings and not rip or tear during donning/doffing.

2 Collection of samples containing high solvent concentrations may liberate volatile organics at levels sufficient to warrant respirator use (in addition to skin protection). This is especially true where high concentrations of materials or chemical layers (floating product) are encountered. Potential emissions should be monitored and protective equipment upgraded as specified in the site specific work plan.

3 During equipment decontamination activities involving extensive use of acetone, hexane, methanol or other solvents, Level C protection including organic vapor cartridges or equivalent, may be warranted.

APPENDIX D (CONTINUED)
HEALTH AND SAFETY
TASK ANALYSIS

SOIL AND WATER SAMPLING

In addition, eye and skin protection may be required during decontamination activities requiring the use of nitric acid. It should also be noted that improper preparation by the laboratory of acid preservatives in sampling containers may release irritating "fumes" unexpectedly upon addition of liquid samples.

4 Transport and storage of chemicals required for decontamination procedures require appropriate safeguards to prevent contact between incompatible and/or combustible materials. Nitric Acid is an oxidizer capable of starting a fire upon contact with flammable or combustible materials.

The following table highlights key precautions for safe work with common sample decontamination materials.

TABLE D-1
COMMON SAMPLE DECONTAMINATION AGENTS
HEALTH AND SAFETY CONCERNS

Chemical	PEL	Safety Hazard	Acute Health Hazard	Chronic Health Hazard	Precautions
Acetone	750 ppm	Flammable	Respiratory Irritation; Dry, Cracked Skin	None Known	Well Ventilated Area; Respirator (OVM); Gloves (1)
Methanol	200 ppm	Flammable	Irritation; CNS; Drowsiness; Light Headedness; Dry, Cracked Skin	Vision Damage (Optic Nerve)	Well Ventilated Area; Respirator (OVM); Gloves (1,2)
Hexane	50 ppm	Flammable	Irritation; Light Headedness; Dry, Cracked Skin	Nerve Damage (Polyneuritis) Numbness, Weakness in Limbs	Well Ventilated Area; Respirator (OVM); Gloves (1,4)
Isopropanol	400 ppm	Flammable	Mild Irritation - eyes, nose, throat; Dry Crack Skin		Well Ventilated Area; Respirator (OVM); Gloves (1,2,4)
Nitric Acid (concentrated 68% solution)	2 ppm	Oxidizer	Irritation of eyes, noise and throat upper tract, respiratory	Corrosive to tissue	Goggles; Skin Covering; Gloves (1,2,3,4); Eye Wash; Avoid Contact with combustibles or flammables.

Notes:
OVM - Organic Vapor Cartridge; PEL – Permissable Exposure Limit; CNS – Central Nervous System; ppm – parts per million
1 = Silver Shield, 2 = Neoprene, 3 = Natural Rubber, 4 = Nitrile

B

APPENDIX B

EQUIPMENT DECONTAMINATION PLAN (EDP)

EQUIPMENT DECONTAMINATION PLAN (EDP)
For the
REMEDIAL INVESTIGATION
OF CHROMITE ORE PROCESSING RESIDUE SITE 116
(STANDARD CHLORINE)
KEARNY, NEW JERSEY

Prepared for:

Chemical Land Holdings, Inc.
Two Tower Center Blvd., 10th Floor
East Brunswick, New Jersey 08816

Prepared by:

Brown and Caldwell
440 Franklin Turnpike
Mahwah, New Jersey 07430

July 2001

19312.001

TABLE OF CONTENTS

LIST OF TABLES

1.0 INTRODUCTION

This Equipment Decontamination Plan (EDP) contains methods and procedures that will be used to decontaminate field equipment used during the Remedial Investigation (RI) activities outlined in the RI Work Plan (RIWP) for Chromite Ore Processing Residue (COPR) Site 116 in Kearny, New Jersey, to be conducted under the terms of an Administrative Consent Order (ACO) dated April 17, 1990.

The decontamination procedures described in this EDP conform to the procedures developed by the New Jersey Department of Environmental Protection (NJDEP) - Division of Hazardous Waste Site Mitigation, Environmental Measurement Section, contained in the following documents:

- Field Sampling Procedures Manual, NJDEP (5/92)
- Administrative Consent Order (4/17/90)
- Field Analysis Manual, NJDEP (7/94)

This document is an integral part of the RIWP and will be used in concert with the Health and Safety Plan (HASP), the Standard Investigative Procedures Plan (SIPP), and the Quality Assurance Project Plan (QAPP) developed specifically for Site 116 (July 2001) and provided as Appendices A, B, and C, respectively, to the RIWP. Methods and procedures described in these documents are not repeated here and are included by reference.

It should be noted that the methods and procedures described in this document will be selectively applied on individual areas of environmental concern, as appropriate. Decontamination activities will be carried out using appropriate HASP and QAPP protocols.

2.0 DECONTAMINATION FACILITIES

The HASP contains descriptions and the procedures for designating various work zones at Site 116. It is planned that three (3) work zones will be established for site control and work activity control during RI activities at Site 116. These work zones include an Exclusion Zone, a Contamination Reduction Zone and a Support Zone. The Exclusion Zone will be the area in which active intrusive work will be performed. The Contamination Reduction Zone will be the area where personal decontamination will take place. The Support Zone will contain the necessary back-up equipment, supplies, and personnel associated with RI field activities.

An Exclusion Zone will be established for each active work area of intrusive work addressed in the RIWP. It will generally be confined to areas immediately around individual intrusive work activity locations and will move as the activity locations move. The exception to this is for work in the former lagoon area in which this entire area will be considered the Exclusion Zone. The Contamination Reduction Zone will be located in an area central to the sampling points of the site. The Exclusion Zone and Contamination Reduction Zone will be defined by traffic cones and/or caution tape around their perimeters.

Equipment decontamination facilities will be located within the Contamination Reduction Zone. Table 2-1 includes the typical equipment and materials needed for the decontamination of equipment, which will be available in the Contamination Reduction Zone.

The decontamination facilities will include two major components: a portable decontamination pad for heavy equipment and a plastic tub for small tools and sampling equipment. A description of each is presented below.

2.1 PORTABLE DECONTAMINATION PAD

A portable decontamination pad will be used for decontamination of heavy equipment and vehicles such as GeoProbe® vehicles, drilling rigs, backhoes, etc. It will consist of a water-tight containment structure, a collection sump, and a submersible pump. A tarpaulin cover will be used to avoid rain water accumulation when the pad is not in use. Various types of these pads are available, some of them are prefabricated, while others can be assembled and disassembled on the work site, depending upon drilling contractor's operating procedures and available materials. The drilling contractor will be required to supply an appropriate unit which is acceptable to the Project Health and Safety Officer (HSO).

2.2 PLASTIC TUB

For smaller pieces of equipment such as GeoProbe® drive tips, split-spoons, and sampling equipment, such as trowels, etc., a large plastic tub will be used to hold the equipment while it is being cleaned. This tub will be located at the Contamination Reduction Zone in the portable decontamination pad.

2.3 DECONTAMINATION WATER HANDLING

Water generated by the decontamination activities described above will be collected in a portable tank and accumulated for bulk sampling and disposal on an as-needed basis. Due to the presence of 2,3,7,8-tetrachlorodibenzodioxin (2,3,7,8-TCDD or Dioxin) in the former lagoon area, and the potential difficulty of off-site disposal of Dioxin-contaminated fluids, efforts will be made to minimize the volume of decontamination water generated during the RI.

TABLE 2-1

CONTAMINATION REDUCTION ZONE EQUIPMENT

Steam cleaner
Portable decon pad
Electric generator
Potable water tank
Portable decontamination water tank
Dedicated hoses and pumps
Plastic tub
Natural bristle scrub brushes
Mild non-phosphate detergent (i.e. Alconox)
2-Five gallon wash buckets
Distilled/Deionized water
Squirt bottles
Pesticide grade acetone
10% nitric acid solution
Aluminum foil
Thirty-gallon plastic container
5 mil polyethylene sheeting
Chem wipes
Paper towels
30 gallon tub
Small table
Basin
Hand soap
Bench
Plastic liners
Boot jack
Personal protective equipment as outlined in the HASP.
Two-way radio

Note: This list may be expanded or reduced depending upon site-specific requirements.

3.0 DECONTAMINATION PROCEDURES

This section contains decontamination procedures which will be used to minimize the potential for cross-contamination between samples and contaminant migration from intrusive activity areas in the Exclusion Zone to other site areas during the RI activities. These procedures are consistent with NJDEP requirements and industry practice for this type of investigative work. The procedures have been presented in tabular format. Table 3-1 summarizes the planned procedures for decontamination of equipment. Tables 3-2, 3-3, 3-4, and 3-5 contain specific detail procedures by the types of equipment which may be employed during RIWP implementation. Downhole equipment such as augers, drill rods, etc., if used, will be transported by a lined pick-up truck, to the Contamination Reduction Zone for decontaminating.

TABLE 3-1

PLANNED DECONTAMINATION PROCEDURES

Equipment	Examples of Equipment	Procedures To Be Used	Frequency
Heavy Equipment	Drill rig, GeoProbe®	A	Must be performed between sampling points (e.g., boring, well, etc.)
Support Vehicles	Pickup truck, flatbed truck	A	Must be performed between sampling points (e.g., boring, monitoring well, etc.) if equipment comes in contact with potentially contaminated material.
Downhole Drilling Equipment	Augers, drill rods, temporary casing	B	Must be performed between sampling points (e.g., boring, well, etc.)
Monitoring Well Casing, Screens	Riser, screen, casing	B	Perform on the day of installation.
Non-dedicated Pumps	Peristaltic	Tubing replaced after each sampling event.	Must be performed between sites or sampling points(e.g., boring, well, etc.)
	Submersible	D	

TABLE 3-1 (CONTINUED)

PLANNED DECONTAMINATION PROCEDURES

Equipment	Examples of Equipment	Procedures To Be Used	Frequency
Monitoring Well Development and Water/Soil Measuring Instruments	Water level meter, pH/ORP/temperature meter, conductivity meter, interface probe	Remove all residue with dry paper towel, wash and scrub any exposed portion with acetone, wash probe with non-phosphate detergent, tap water rinse, distilled/deionized water rinse, 10% nitric acid rinse, distilled/deionized water rinse, acetone rinse, distilled/deionized water rinse, air dry.	Perform before first use and after each subsequent use.
Permeability Testing Equipment	Data logger cables, metal slug	C	Perform before first use and after each subsequent use.
Surface Water Sampling Equipment	Pond sampler, bottle sampler	C	Perform before first use and after each subsequent use.
Non-disposable Sediment and Surface Soil/Waste Sampling Equipment	Steel trowel, steel shovel, dredge, steel mixing bowl*	C	Perform before first use and after each subsequent use.

TABLE 3-1 (CONTINUED)

PLANNED DECONTAMINATION PROCEDURES

Equipment	Examples of Equipment	Procedures To Be Used	Frequency
Soil Sampling Equipment	Split-spoon, hand auger, Shelby tube	B, C	Before first use, use Procedure B followed by Procedure C. Between sampling intervals in one location, use Procedure C. Between each borehole, use Procedure B followed by Procedure C.
Scrape and Chip Sampling Equipment	Chisel, hammer, sample stick, spatula	C	Perform before first use and after each subsequent use.

* Do not utilize stainless steel.

TABLE 3-2

PROCEDURE A

Typical Equipment and Supply List

- Portable decontamination pad
- Portable steam cleaner
- Potable water source (portable tank with pump where direct supply is unavailable)
- Power supply for pumps (generator when direct supply is unavailable)
- Natural bristle scrub brush
- Garden shovel or garden hoe

Step-By-Step Approach

1 Scrape and brush off potentially contaminated material and place in containers for transport to drill cutting collection dumpster. This dumpster is described in the SIPP.

2 Move equipment onto decontamination pad.

3 Using steam and manual scrubbing, thoroughly clean equipment inside and out until visible soil, oil, grease and other foreign materials are removed.

4 Move equipment to Support Zone or another on-site work area.

5 Sweep up and place in container materials that may have been tracked onto the surface of the portable decontamination pad.

TABLE 3-3

PROCEDURE B

Typical Equipment and Supply List

- Portable steam cleaner
- Plastic tub
- Potable water source (portable tank when direct supply is unavailable)
- Power supply for pump (generator if direct supply is unavailable)
- Natural bristle brush
- Garden shovel or garden hoe
- 5-mil polyethylene sheeting

Step-by-Step Approach

1 Scrape and brush off potentially contaminated material and place in containers for transport to drill cutting collection dumpster. This dumpster is described in SIPP.

2 Place equipment (to be decontaminated) on support truck that has polyethylene sheeting covering the bed and transport equipment to the plastic tub.

3 Unload and place the equipment into the tub. Perform steam wash and manually scrub the equipment inside and out until visible soil, oil, grease or other foreign material are removed.

4 Wrap equipment in clean polyethylene for transportation and/or use at other location.

5 Decontaminate support truck, if necessary, in accordance with Procedure A.

TABLE 3-4

PROCEDURE C

Typical Equipment and Supply List

- Mild non-phosphate detergent (e.g., Alconox)
- 2-five gallon wash buckets or equivalent volume pans
- 2 natural bristle scrub brushes
- Pesticide grade acetone (for organics only)
- Distilled/deionized water
- 2 squirt bottles
- 10% nitric acid solution (for metals only)
- Potable water
- Aluminum foil

Step-by-Step Approach

1 Wash equipment with mild non-phosphate detergent solution. Scrub with natural bristle brush to remove foreign material.

2 Rinse with potable water.

3 Rinse with distilled/deionized water.

4 Rinse with 10% nitric acid solution.

5 Rinse with distilled/deionized water.

6 Rinse with pesticide grade acetone.

7 Rinse with distilled/deionized water.

8 Air dry or blow dry with nitrogen.

9 Wrap equipment in aluminum foil.

TABLE 3-5

PROCEDURE D

Typical Equipment and Supply List

- 30-gal plastic trash can
- Mild non-phosphate detergent (e.g., Alconox)
- Distilled/deionized water
- Potable water
- Scrub brushes
- 5-gal buckets
- Paper towels
- Power supply for pump (generator if direct supply is unavailable)

Step-by-Step Approach

- Wipe pump with paper towels to remove visual contamination.
- Wash/scrub exterior of equipment with acetone.*
- External Potable water and non-phosphate detergent wash.
- Potable water rinse.
- Pump 20 gallons of potable water through pump.
- External distilled/deionized water rinse.
- External 10% nitric acid rinse.
- External distilled/deionized water rinse.
- External acetone rinse.
- External distilled/deionized water rinse.
- Air dry.

---

* As necessary to remove NAPL or other stubborn contamination if present.

Note: Decontamination of pump only. Discharge hose shall be dedicated for each well.

C

APPENDIX C

STANDARD INVESTIGATIVE PROCEDURES PLAN (SIPP)

STANDARD INVESTIGATIVE PROCEDURES PLAN (SIPP) FOR THE REMEDIAL INVESTIGATION AT CHROMITE ORE PROCESSING RESIDUE SITE 116 (STANDARD CHLORINE) KEARNY, NEW JERSEY

Prepared for:

Chemical Land Holdings, Inc.
Two Tower Center Blvd., 10th Floor
East Brunswick, New Jersey 08816

Prepared by:

Brown and Caldwell
440 Franklin Turnpike
Mahwah, New Jersey 07430

July 2001

19312.001

TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

This Standard Investigative Procedures Plan (SIPP) contains standard work methods and procedures that will be used for the Remedial Investigation (RI) field activities outlined in the RI Work Plan (RIWP) of Chromite Ore Processing Residue (COPR) Site 116 in Kearny, New Jersey. This investigative approach as presented in this plan conforms to the requirements of the Administrative Consent Order (ACO) dated April 17, 1990. Furthermore, field sampling procedures described in this document are consistent with the requirements and procedures described in N.J.A.C. 7:26E (revised May 15, 2000) and the New Jersey Department of Environmental Protection's (NJDEP) "Field Sampling Procedures Manual," dated May 1992.

This document is an integral part of the above referenced RIWP. It should be noted that all methods and procedures described in this document may not apply to RI activities at each area of investigation within Site 116.

Field activities will be carried out in conjunction with the following documents dated July 2001: health and safety protocols described in the Health and Safety Plan (HASP); field equipment decontamination methods described in the Equipment Decontamination Plan (EDP); and Quality Assurance/Quality Control Protocols described in the Quality Assurance Project Plan (QAPP).

2.0 DRILLING

2.1 GENERAL

Drilling activities will be performed by New Jersey-licensed well drillers, under the supervision of a qualified and experienced geologist. Drilling permits (as necessary) will be obtained prior to any drilling as provided under N.J.S.A. 58: 4A-14. Site access will be obtained by Brown and Caldwell with assistance from Chemical Land Holdings, Inc. (CLH) representatives and NJDEP. Prior to any intrusive work, underground storage tanks (USTs), other structures (e.g., septic waste systems), utilities, such as gas, electric, oil pipelines, telephone, sewer, and water lines will be identified and locations of boreholes will be adjusted to prevent damage to such structures and utilities. This clearance procedure will utilize the resources of the New Jersey One-Call Service, private utility mark-out contractors, as necessary, and available historic site information. Similarly, overhead power lines and buried utilities will be avoided.

Drilling equipment will be steam-cleaned prior to arrival at the site. Drilling equipment with hydraulic system, lubricant, and/or fuel leaks will not be allowed on the site. During the drilling of a borehole or construction of a monitoring well, drilling equipment will be decontaminated as outlined in the EDP.

The drilling rig will be set up and operated in accordance with standard drilling practice, and in a manner that will allow for safe and efficient operation of the equipment. Disturbance to the site and interim remedial measure (IRM) coverings will be kept to a minimum. Drilling operations on-site will include monitoring for potential organic and explosive vapors, as well as, oxygen, hydrogen sulfide, and particulates, to protect the RI workers. Safety considerations and procedures pertaining to equipment operation and personal protection are addressed in the HASP.

2.2 HOLLOW-STEM AUGER DRILLING

2.2.1 Pilot Holes at IRM Sites

A pilot hole will be used as a starter hole for hollow stem augers. Three different types of IRM work have been completed at Site 116. The following is a description of each type of IRM activity.

2.2.1.1 Paved IRM Site Areas. These areas were first graded and the original surface covered with a porous geotextile fabric for dust control. The geotextile was then overlain with 4 to 6 inches of coarse aggregate, followed by coverage with 4 inches (average) of asphalt paving (see Figure 2-1).

2.2.1.2 Aggregate-Covered IRM Site Areas. These areas were graded and the surface covered by 4 to 6 inches of coarse aggregate subbase. The subbase was overlain with a sandwich layer of geotextile-geomembrane-geotextile. This layer was overlain with 4 to 12 inches of coarse aggregate (see Figure 2-2).

2.2.1.3 Embankment Cover IRM Site Areas. These areas were graded and the surface covered with a layer of geomembrane liner. The geomembrane liner was held-down with sand bags attached to 18" stakes of #3 rebar (see Figure 2-3). It should be noted that this IRM covering is not expected to be disturbed as per Figure 116-2.15 of the RIWP dated July 2001.

2.2.1.4 Pilot Hole Installation Procedures. At each borehole location, a starter or pilot hole will be made to avoid tearing of geomembrane. This pilot hole will be completed using the following method:

1 Hand excavate the aggregate to the first layer of geotextile. The diameter of the excavation shall be 1 foot larger than the diameter of the auger that will be used

for advancing the borehole. If pavement is present, it will be saw cut. Aggregate removed from the excavation will be stockpiled on polyethylene sheeting away from the borehole. The excavated pavement will be collected in bulk containers for disposal off-site.

2 Carefully cut each layer of geotextile and/or geomembrane with a utility knife.

3 Continue excavation of aggregate until original pavement or soil is reached and stockpile aggregate on a separate polyethylene sheet.

4 Obtain sample of soil/fill material encountered immediately beneath the IRM coverings (and any previously paved or gravel surfaces) for chemical analysis from the 0 to 6 inch depth, if required.

5 Drive appropriate size casing (precut to length) 6 inches into the ground immediately below IRM covering, if present, using casing driver. This casing will keep the excavated hole open and will serve as a conduit for soil cuttings, thereby keeping potential subsurface contamination from coming in contact with the IRM covering. The casing will also protect the geomembrane and/or geotextile layer.

6 Place a 4 foot by 8 foot sheet of plywood staging, or a 10 foot x 10 foot 30 mil polyethylene sheeting around the borehole. This staging will keep drill cuttings from contacting the IRM covering.

7 Advance borehole using methods outlined in Section 2.2.2.

8 After necessary information and/or samples have been collected, repair IRM work using methods outlined in Section 2.5.2 or 2.5.3, as appropriate.

2.2.2 Advancing Augers

During any intrusive activities (e.g., drilling, groundwater sampling), field personnel will perform air monitoring at that location utilizing an organic vapor detector, O_2 meter, H_2S meter, Combustible Gas Indicator, and a particulate meter.

Drilling will be performed using various sizes of hollow-stem augers (HSA) equipped with a removable center plug to facilitate split spoon sampling. In areas where IRM work has been performed, boreholes will be advanced through pilot holes constructed prior to drilling. Monitoring wells that penetrate the "meadow mat" or peat layer will be augered using 12-1/4 inch I.D. augers (see Section 3.1.2) to the meadow mat, followed by an 8-inch steel casing installed to seal off the water-bearing formation above the meadow mat. They will be completed with 6-1/4-inch I.D. augers which penetrate through the casing. All other boreholes and monitoring wells will be drilled using 2-1/4 inch to 4-1/4 inch I.D. augers for the boreholes, and 6-1/4 inch I.D. augers for the shallow monitoring wells. The hollow-stem augers will be advanced using a drilling rig as follows:

1 Advance the boring by rotating and advancing the augers the desired depth into the ground in accordance with ASTM practice D1452-80(2000). The borings must be advanced incrementally to permit continuous recovery of soil and/or residue samples for geologic profiling. Samples will be collected using a split-spoon sampler, Shelby tube sampler or other appropriate sampling device.

2 Collect drill cuttings and place in bulk container for subsequent disposition. Disposal of cuttings is discussed in Section 6.1.

3 Remove center plug from augers and collect sample. If flexible center plugs are used, install sampling device through the plug.

4 Withdraw sampling device. Lower center plug into augers and advance auger to next sampling depth. The auger will be advanced to a depth in such a manner that minimum disturbance is caused to the ground below the depth interval designated for sample collection.

5 If the meadow mat is to be penetrated (for installation of the monitoring wells), the borehole will be double-cased prior to penetration of the meadow mat, utilizing methods outlined in Section 3.1.2. The lower clay confining layer will not be penetrated more than six inches.

6 The borehole will be advanced, with appropriate soil sampling, until the designated termination depth is reached, as specified in the RI work plan. The only exception will be if "refusal" occurs during split-spoon sampling, as defined in Section 2.2.3. Refusal may occur if the driller encounters such unknown obstructions as bedrock (not expected), rubble, or a boulder. If refusal occurs while sampling, the obstruction will first be attempted to be cleared by rotating the HSA bit through the obstruction. If the HSA cannot penetrate the obstruction, the borehole will be abandoned and backfilled as described in Section 2.5. Should abandonment of a borehole become necessary before the appropriate termination depth, one relocation attempt will be made to obtain a boring to the planned depth. The initial boring will be abandoned in accordance with procedures given in Section 2.5. This relocated boring will be located approximately 5 feet away from the abandoned borehole. If the relocated borehole also meets "refusal", the second borehole also will be properly abandoned, and the planned boring location will be deemed complete, even if the planned depth has not been reached. However, if the planned boring location was to have a monitoring well installed, the various options will be discussed with NJDEP and CLH before proceeding.

2.2.3 Split-Spoon Sampling

Split-spoon samples will be collected in accordance with ASTM Method D1586-99, "Standard Method For Penetration Test and Split-Barrel Sampling Procedures" described below.

1 Once the boring is advanced to the desired sampling depth using hollow-stem augering procedures, attach split-spoon sampler to the drill rods and lower into borehole. Do not allow sampler to drop onto the soil to be sampled.

2 Position the hammer and anvil and attach to the drill rods.

3 Rest the weight of the sampler, drill rods and hammer on the bottom of the boring and apply a seating blow. If excess cuttings are encountered (not expected, since center plug is to be used), remove sampler from the borehole and spin augers until the excess cuttings are removed.

4 Mark the drill rods in four successive 6-inch increments so that the advance of the sampler under the impact of the hammer may easily be observed for each 6-inch increment.

5 Drive the sampler with blows from a 140-pound hammer raised 30 inches and allowed to strike the anvil. Count the number of blows applied in each 6-inch increment until one of the following occurs:

- A total of 50 blows have been applied during any one of the four 6-inch increments.
- A total of 100 blows have been applied.

- There is no observed advancement of the sampler during the application of 10 successive blows. If any of the three above circumstances occur, "refusal" will be declared for this depth, and recorded as such.
- The sampler is advanced the complete length (18 or 24 inches).

6 Record the number of blows required for each 6-inch penetration or fraction thereof. The first 6 inches is considered the seating drive. The sum of the second and third 6 inches of penetration is considered the "Standard Penetration Resistance" or the "N" value. If sampler is driven less than 18 inches, the number of blows per completed 6 inches will be recorded on the boring log. If the sampler penetrates the full length under the static weight of the drill rods, this information will be recorded on the boring log.

7 Bring the spoon to the surface and open. Take a photograph. Record the percent recovery or the length of soil sample recovered and the interval occupied by the sample in the split spoon (e.g., top 25%, bottom 40%). Describe the soil samples recovered with regard to such characteristics as composition, color, stratification, and other pertinent information, as outlined in Section 2.4.2. Obtain a representative sample for chemical analyses or other purposes from the prescribed intervals of the boring (see Section 5.1). If duplicate samples are required, sufficient sample should be removed from the spoon to perform mixing for homogeneity, followed by splitting the mixed sample into the designated sample containers. The remainder of the sample may then be disposed of according to protocols described in Section 6.1, unless a sample is specified for physical testing of soil properties, such as grain size distribution or Atterberg limits, or other purposes. If a sample is to be submitted for physical testing, place the remainder of the sample into a soil sample jar without distorting the original stratification. Seal container to minimize evaporation and affix label identifying site, boring number, sample depth, the number of blows per six inches, and the testing to be done on the sample.

The ASTM procedure may be modified during the field investigation by driving the sampler the entire length of the split-spoon (24 inches), and/or using a 3-inch diameter sampler. The 3-inch diameter sampler will be used, as appropriate (mainly if the sample recovery in coarser materials is poor).

2.2.4 Shelby Tube Sampling

Sampling in soft sediments (e.g., silts, clays) and in meadow mat may be conducted using ASTM Method D1587-00 "Standard Practice for Thin-Walled Tube Sampling of Soils," as described below, when relatively intact soil samples are required for geotechnical laboratory testing.

1 Advance the boring to the desired sampling depth using hollow-stem augering.

2 Use 3-inch diameter, 36-inch long thin-walled tube.

3 Attach sampler tube to the sampler head and drill rods. Lower sample tube so that the bottom rests on the bottom of the borehole.

4 Push the sampler tube with the drive head of the drilling rig (without rotation) with a continuous rapid motion.

5 Continue to push until the full length of the tube (less 3 inches) has been advanced or until formation resistance does not allow further advancement without damaging the tube. In no case will the length of advance be greater than the sample tube length, less 3 inches for cuttings.

6 Rotate the drill rods to shear the bottom of the sample after pushing is complete.

7 Upon retrieval of sample tube, inspect tube for damage and measure total length of sample recovered. Remove disturbed material from top of tube, and remeasure length. Seal the upper end of tube. Remove the bottom 1 inch of disturbed material from the tube. Seal lower end of tube. Seal the tube ends with hot beeswax and wrap with cheesecloth.

8 Label tube with the site location, boring number, and depth at which the sample was taken. Also label sample orientation (e.g., this side up).

9 Prepare sample for shipment to the laboratory and place sample in shipping container. Place orientation label on shipping container. Ship sample tubes in an upright position.

2.2.5 Rock Coring

Diamond core drilling procedures ("rock coring") may be used should consolidated bedrock drilling become necessary. Rock core runs will be five (5) feet and the core size will be "NX" (2-1/2") diameter. ASTM Method D2113-99 "Standard Practice for Diamond Core Drilling for Site Investigation" will be used.

1 Advance boring using hollow-stem augers to refusal. Set 6-inch steel casing in borehole and pressure grout using procedures described in Section 3.1.2. Allow 24 hours for cement grout to cure before continuing.

2 Prepare for coring by setting up water recirculation system.

3 Assemble and lower the NX-sized double-tube swivel-type core barrel into the casing. Perform coring until the total length of core run has been completed or blockage occurs. Blockage is signaled when lack of water return occurs or water flow into the core barrel is restricted.

4 Remove the core barrel from the hole and disassemble to remove the core. Reassemble the core barrel and return it to the rock hole.

5 Place recovered core in wooden core box with upper end of core at the upper left hand corner of the box. Fit fractured, bedded, or jointed rock pieces together, to the degree possible, as they naturally occurred.

6 Wet wipe and clean core. Photograph each core.

7 Record rock properties as outlined in Section 2.4.4 including: lithology, fracturing, weathering, percent recovery, Rock Quality Designation (RQD), and unusual occurrences.

8 Label core box lid and end with project name, site number, boring identification, footage range, and box number.

2.3 SOIL SAMPLE COLLECTION USING GEOPROBE® SAMPLERS

As an alternative method for collecting soil samples above the meadow mat, the direct push technology (GeoProbe®) may be used. Soil samples obtained using the GeoProbe® are collected in a clear acetate liner that is approximately two inches in diameter and four feet in length (Macro-core). This liner is placed inside a steel chamber and connected to the leading end of a direct push rod. The rod is then pushed or pneumatically driven into the subsurface. When the desired depth is reached, the sampler is retrieved and the liner removed. A new liner is then placed in the chamber and additional rods are connected to drive to the second depth interval. This is repeated until the total depth (most commonly to the top of the meadow mat) or refusal is reached.

Soil sample collection will be conducted using the following procedures:

1. When the acetate liner has been retrieved, it will be placed on a clean piece of plastic sheeting and cut open with a utility knife. The sheeting will be replaced between each four-foot interval to avoid possible cross-contamination. The length and position of the recovered sample in the acetate liner will be measured and noted in the field log book. If there is insufficient recovery, an additional boring may be drilled close-by.

2. A photograph will be taken of the sample intervals from the acetate liner with a board including sample identification, date, time, and name of the field representative. The soil will be classified in the field using the Burmister system and noted in the field log book. Unified Soil Classification System (USCS) descriptors will be assigned during subsequent boring log preparation.

3. Representative samples of the soil core will then be collected using a plastic spoon and transferred into plastic bags. The samples will be homogenized and placed in the appropriate sample containers. For field duplicates or replicates, homogenization of the source sample shall include sufficient volume such that transfer to the sample containers takes place in a single sequence and results in samples that are as representative of the source sample as possible.

4. The sample containers will then be immediately placed in a cooler with sufficient ice to maintain a temperature of 4 degrees C or less.

5. Field measurements will be taken for temperature, pH and oxidation-reduction potential (ORP) from each sample and recorded in the field log book. The measurement will be taken from a slurry made by mixing approximately 5 grams of soil and 10 ml of laboratory grade distilled water in a small plastic cup. (pH and ORP will be recalibrated every 10 samples)

6. All plastic bags, spoons, acetate liners, cups and gloves will be disposed and new materials used for the next sample. The generated waste will be held in an appropriate container(s) for subsequent waste characterization and disposition.

Soil cuttings may be returned to the borehole if it is decided by the field leader that the following criteria has been met:

- The cuttings are not likely to be contaminated, or:
- The cuttings are likely to be contaminated and the surface soils are known to be contaminated, and
- The disposed soil will not spill offsite, and
- There is no potential to contaminate an uncontaminated aquifer, and
- There is no potential to create a health hazard through airborne exposure.

Bentonite pellets will be added to replace soil removed for sample collection and the top of the bore hole will be patched with asphalt or aggregate as appropriate. The pellets will be added to the depth interval that appears to be least contaminated. In the event that the borehole is extended below the bottom of the meadow mat, the boring will be abandoned by grouting the borehole with bentonite slurry using the tremie method.

The boring location will be documented and a sketch will be included in the field logbook, including measurements to permanent or semi-permanent benchmarks, as appropriate. The location will be marked in the field with spray paint or other means appropriate to site conditions prior to being surveyed, as appropriate, at a subsequent date.

2.4 VISUAL IDENTIFICATION/GEOLOGICAL DESCRIPTION

2.4.1 Field Equipment Requirements

The Field Geologist will prepare geologic descriptions of the in-place subsurface soils, residue, and/or bedrock, and collect representative samples from the prescribed intervals for physical (geotechnical and geological) and/or chemical laboratory testing. Prior to the start of drilling operations, care will be taken that the necessary equipment and supplies are available, in good working order, and/or properly decontaminated, such as the following:

- Copies of RIWP, QAPP, HASP (with map to nearest hospital), EDP, and SIPP
- List of appropriate contacts, with phone numbers
- Cellular telephone and/or two-way radio
- Field logbook and paper
- Site topographic map
- Classification guide sheets and soil color charts
- Waterproof marking pens (for sample boxes and containers)
- Sample jars and chemical analysis vials and bottles
- Plastic and steel mixing bowls
- Plastic and steel scoops
- Surveyor's flagging tape
- Six-foot rule
- Water level indicator (electronic)
- Acid (10 percent HCl)
- Geologist's hammer
- Pocket penetrometer
- Pocket knife or screw driver
- Camera (digital, 35mm or Polaroid, with color film)
- Hand lens

- Thermometer
- Conductivity and turbidity meters
- pH meter or narrow range pH paper, ORP and dissolved oxygen (DO) measuring devices
- Hand level
- Shovel
- 100-foot tape (weighted for monitoring well installation)
- Air horn
- Health and safety equipment, per HASP
- Field monitoring instruments, per HASP
- Other specialized equipment per site-specific work activities

2.4.2 Soil Descriptions

Soils will be classified in the field using the Burmister system. This system provides the information necessary to develop the corresponding USCS classification. Both descriptions will be provided on the final boring logs. A description of the Burmister system is provided in Table 2-1.

Soil properties required to define the Burmister designation of a soil, and provide a geologic description, are the primary features considered in field identification. These properties and other observed characteristics normally identified in describing soil include:

A Color (using Munsell color chart)
B Moisture condition
C Grain size

1 Estimated maximum grain size
2 Estimated percent by weight of fines (material passing No. 200 sieve)

D Gradation (well graded, poorly graded)

E Grain shape (angular, subangular, rounded)

F Plasticity

G Predominant soil type

H Secondary components of soil

I Classification symbol

J Other features such as:

- Organic, chemical, or metallic content
- Compactness
- Consistency
- Cohesiveness near plastic limit
- Dry strength
- Source - residual, or transported (aeolian, waterborne, glacial deposit, etc.)

2.4.3 Chromite Ore Processing Residue Description

COPR has several distinctive features generally not found in natural soil or in manmade fills originating from other sources. It is predominantly reddish in color (due to a high iron oxide concentration), but may exhibit a greenish or yellowish "blush" on the surface where chromium salts have migrated to the surface via capillary action or evapotranspiration, and have been left behind when the water evaporated. The residue is typically coarsely granular, ranging in size from fine to medium sand-size particles to small gravel-sized particles. The granules are also typically rounded and pitted, due to their slag origins (recrystallization of the material in air after processing typically produces rounded and pitted particles).

2.4.4 Rock Descriptions

Where rock core drilling is necessary, rock core descriptions will include the following features, as appropriate, for identification purposes:

- Lithology
- Fracture frequency
- Degree of weathering of rock and fractures
- Fracture fit
- Fracture spacing
- Orientation of fractures
- Odors and stains present in rock core
- Percent recovery
- Percent RQD

In addition to the core description, other data such as drilling rate, water losses to the formation, groundwater levels, appearance of drilling water, and presence of voids will be recorded on the boring log forms.

2.5 SEALING OF BOREHOLES

Boreholes that do not have a monitoring well installed will be sealed (plugged) during the same day of drilling unless logistically impossible or unusual circumstances are encountered. Sealing will be achieved by filling the borehole with a cement/bentonite grout (refer to Section 2.5.1), plus adding the appropriate surface treatment to repair the IRM covering, as applicable. The grout will be introduced under pressure from the bottom of the boring using either a tremie pipe or the drill rods. Borehole plugging will conform with the requirements outlined in N.J.A.C. 7:9-9 including the submittal of appropriate documentation by a certified well sealer, as necessary.

2.5.1 Boreholes Outside IRM Site Areas

Soil borings in areas where there have been no IRM coverings will be sealed using the following procedures:

1 Prepare grouting material with the following specifications:

- 8 gallons of potable water
- 5 pounds of bentonite powder
- 94 pound bag of cement

2 Calculate the volume of the borehole based on the bit or auger head diameter plus 10%, and the boring depth, and determine the volume of grout to be emplaced. Generally, the total mixed volume is the borehole volume plus 20%.

3 Mix the grout to be emplaced.

4 Record the type and amount of materials used during the mixing operation. Check to verify that the ratios are within specification tolerance.

5 Place tremie pipe near bottom of borehole and begin pumping the grout.

6 Continue pumping until return circulation of grout is observed.

7 Remove surface casing, drilling rods, and/or tremie pipe.

8 Completely fill the borehole and clean surface near the borehole. Level the ground to about the pre-existing grade. Add grout or cement as necessary to the area near the borehole.

9 Make a follow-up check at each sealed borehole within 7 to 10 days of completion. Document the visit and record any action taken.

2.5.2 Boreholes in Paved IRM Site Areas

1 Grout borehole to original surface, but below IRM covering (see Figure 2-1), using the methods outlined above. Allow 24 hours for cement grout to cure.

2 Clean surface around borehole. Remove steel plate and casing.

3 Enlarge excavation of IRM surface to a diameter 6 inches larger than the hole cut in the geotextile. Stockpile coarse aggregate on polyethylene sheeting.

4 Place patch of geotextile over hole. Provide for a minimum 6-inch overlap. If borehole has a monitoring well installed, cut hole in geotextile patch slightly larger than the diameter of the casing and place patch around casing.

5 Replace stockpiled coarse aggregate. Fill remainder of hole with appropriate IRM material.

2.5.3 Boreholes in Aggregate-Covered IRM Site Areas

1 Grout borehole to original surface, but below IRM covering (see Figure 2-2), using the methods outlined above. Allow 24 hours for cement grout to cure.

2 Clean surface around borehole by removing the 10 foot by 10 foot, polyethylene sheeting protecting the IRM surface adjacent to the borehole. Remove steel plate and temporary casing which was used to also protect the IRM covering while drilling.

3 Cut top layer of geotextile and geomembrane to allow for patching of lower geotextile layer. Patch lower layer of geotextile, providing appropriate overlap.

4 Patch geomembrane layer using manufacturer-recommended geomembrane patch and patching technique. If borehole has a monitoring well installed, place geomembrane collar patch around riser pipe and patch with the appropriate manufacturer-recommended patching technique.

5 Patch top layer of geotextile, providing a minimum 6-inch overlap.

6 Replace stockpiled coarse aggregate to appropriate elevation.

BURMISTER SOILS CLASSIFICATION SYSTEM

The Burmister Soils Classification system is the preferred standard method for the visual classification of soil samples. This standard will be used for the description of all soil samples collected during hydrogeologic and geotechnical investigations from boreholes, test pits, and test trenches, etc. Geologic descriptions using the Burmister Classification system should be employed and follow the format described by Burmister (1958). The following descriptions represent the methods in which the Burmister Soils Classification System should be used.

Component Major Divisions

Component	Size	Grain Size	
		mm	Inches
Gravel	Coarse	25.4 – 76.2	1.0 – 3.0
	Medium	9.53 – 25.4	0.375 – 1.0
	Fine	2.0 – 9.53	0.08 – 0.375
Sand	Coarse	0.64 – 2.00	0.025 – 0.08
	Medium	0.25 – 0.64	0.01 – 0.025
	Fine	0.075 – 0.25	0.003 – 0.01
Fines		<0.075	<0.003
		(passes #200 Sieve)	

Description of "Fines" Fraction

Grain Size	Plasticity	Thread Diameter	
		(mm)	(inches)
SILT	None	6.0	1/4
Clayey SILT	Slight	6.0	1/4
SILT & CLAY	Low	3.0	1/8
CLAY & SILT	Medium	1.5	1/16
Silty CLAY	High	0.8	1/32
CLAY	Very High	0.4	1/64
Other Indicators:			
	Dilatancy Strength Shine		

Definitions of Component Proportions

Description	Percentage by Weight
and	35 to 50
some	20 to 35
little	10 to 20
trace	1 to 10

A (+) and (-) sign can be used to designate the lower (-) limit or upper (+) limit of a given range.

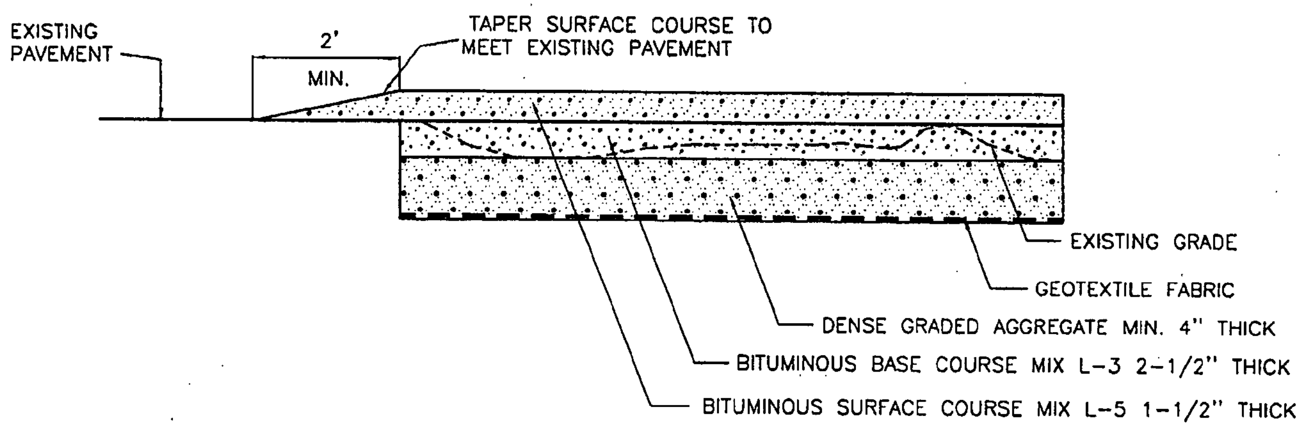
NEVER use the above descriptive terms to distinguish the fine fraction; i.e., SILT & CLAY, or between the fine, medium, and coarse fractions of SAND and/or GRAVEL.

Gradation of Granular Components

As Written	Symbol
coarse to fine	cf
or	
coarse medium fine	cmf
coarse to medium	cm
medium to fine	mf
medium	m
fine	f

Capitalization

- Major Component(s) — All Capitals
- Minor Components — Initial Capitals
- Gradation of Components — All Lower Case
- Color — Initial Capitals
- Other Descriptors — Lower Case, Separated by Commas



NOT TO SCALE

FIGURE 2-1

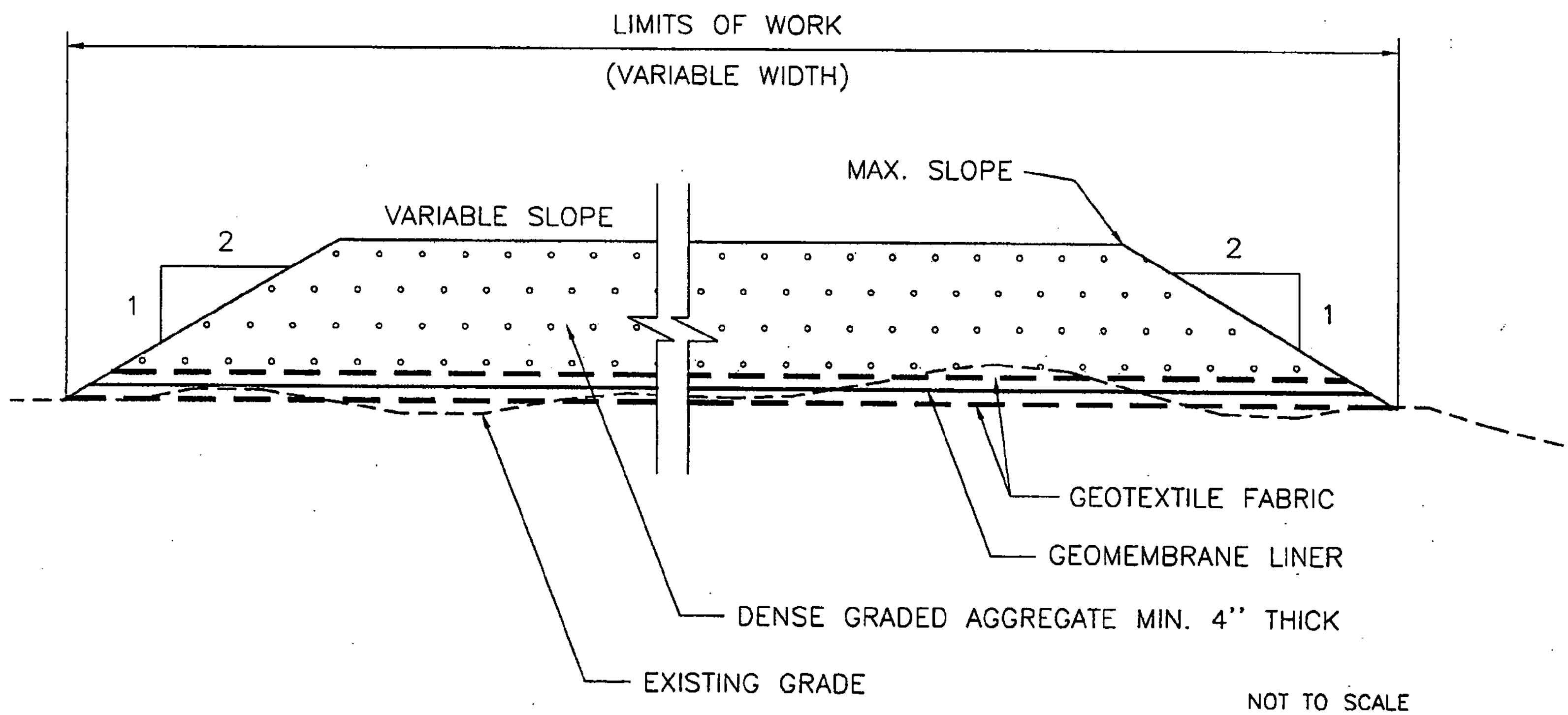
TYPICAL SECTION FOR PAVED IRM AREAS

STANDARD CHLORINE
SITE NO. 116
KEARNY, NEW JERSEY

BROWN AND CALDWELL Mahwah, New Jersey

SOURCE: EFP ASSOCIATES, INC., 1990

RI116-20 06/06/01 PLOT 1=1 (RI116-16.PCP)



NOT TO SCALE

FIGURE 2-2

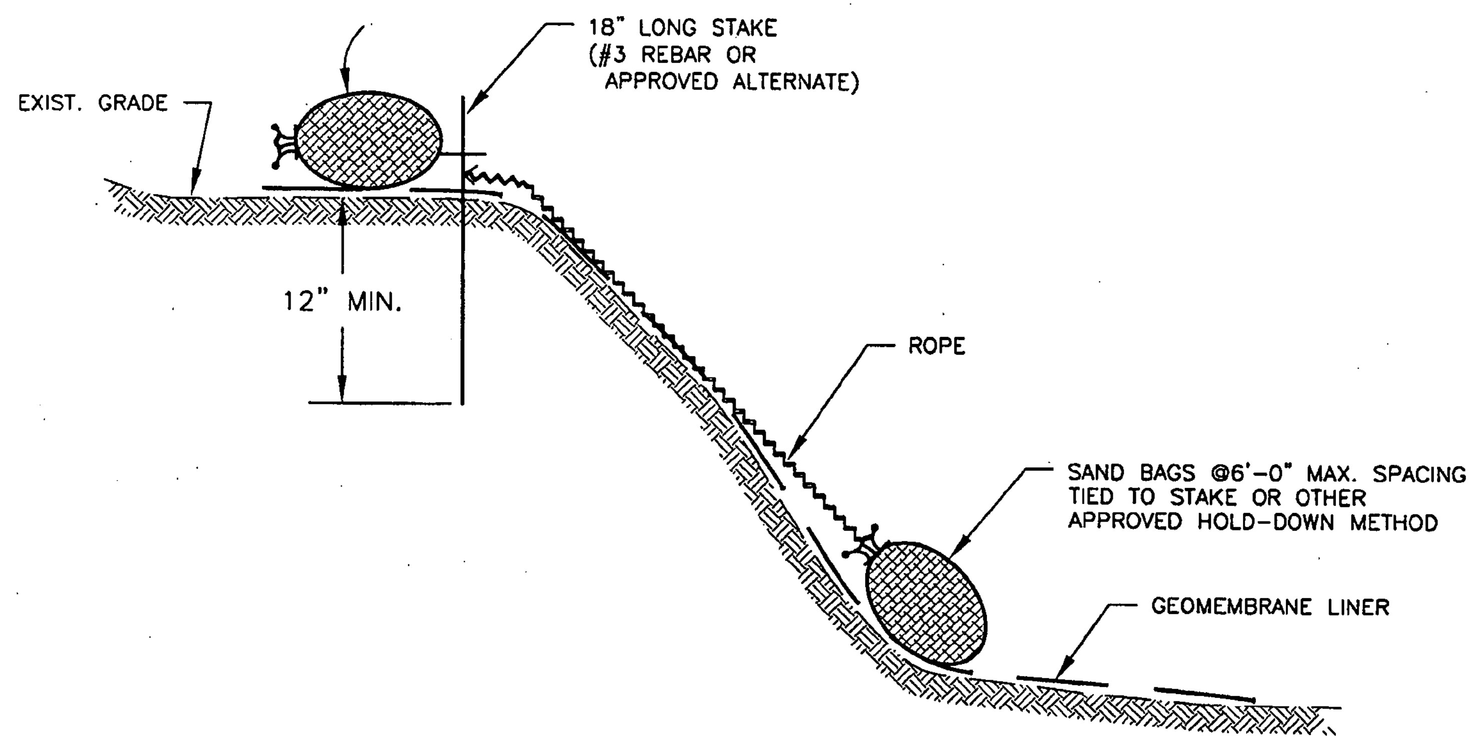
TYPICAL SECTION FOR AGGREGATE IRM AREAS

STANDARD CHLORINE
SITE NO. 116
KEARNY, NEW JERSEY

BROWN AND CALDWELL Mahwah, New Jersey

SOURCE: EFP ASSOCIATES, INC., (1990).

RI116-19 06/06/01 PLOT 1=1 (RI116-16)



SCALE: N.T.S.

FIGURE 2-3

TYPICAL SECTION
FOR EMBANKMENT COVER
IRM AREAS

STANDARD CHLORINE
SITE NO. 116
KEARNY, NEW JERSEY

BROWN AND CALDWELL Mahwah, New Jersey

SOURCE: FRENCH & PARRELLO ASSOCIATES, P.A., 1991

RI116-29 06/21/01 PLOT 1=1 (RI116-29.PCP)

3.0 GROUNDWATER MONITORING WELLS

3.1 MONITORING WELL CONSTRUCTION

Three types of groundwater monitoring wells may be used during the RI. They include:

1 Wells constructed of 2-inch Schedule 40 PVC casing and screen for monitoring groundwater quality and evaluation of the hydrogeology in the fill unit above the meadow mat. Well screen slot-size will be field determined based upon the lithology of the interval to be screened. It is expected that either 0.010 inch slot size with Morie No. 00 or 0 sand or 0.020 inch slot size with Morie No. 0 or 1 sand will be utilized in order to maximize the filtering capacity of the well and produce low-turbidity samples. Well screen lengths are generally ten (10) feet long and will straddle the water table for the uppermost water-bearing zone. In the event that a ten (10) foot well screen cannot be installed due to minimal saturated thickness above the meadow mat, a shorter screen will be used. These will be referred to as shallow groundwater monitoring wells (Figure 3-1).

2 Wells constructed of 2-inch Schedule 40 PVC casing and screen for monitoring groundwater quality and evaluation of the hydrogeology in the sand layer below the meadow mat. Well screen slot-size will be field determined based upon the lithology of the interval to be screened. It is expected that either 0.010 inch slot size with Morie No. 00 or 0 sand or 0.020 slot size with Morie No. 0 or 1 sand will be utilized in order to maximize the filtering capacity of the well and produce low-turbidity samples. Well screen lengths are stipulated for each location in the RIWP. These are generally five (5) feet long and located entirely below the meadow mat. In the event that a five (5) foot well screen cannot be installed below the meadow mat, due to the absence of a thick-enough groundwater-bearing zone, a shorter screen will be used. These will be referred to as deep wells (Figure 3-2).

3 Bedrock monitoring wells are drilled through the shallow overburden and approximately 15 feet into the underlying bedrock. The wells will be constructed of 2" PVC riser and screen for monitoring the bedrock water-bearing zone (Figure 3-3).

The monitoring well designs will conform to N.J.A.C 7:9-6.3 with the exception of 2-inch casing and screen substituted for 4-inch casing and screen. Two-inch casing and screen will be used, rather than the four-inch, to minimize the amount of cuttings generated (and thus disposed). A six-inch diameter borehole is needed for a two-inch casing versus an eight-inch borehole for a four-inch casing. Additionally, a two-inch casing is ample for the needs of the RI. Collection of water samples, measurement of water levels, and permeability (slug) tests can all be done adequately on two-inch diameter wells. Two-inch wells have been previously used for RI investigations in New Jersey and are anticipated to be acceptable to the NJDEP. The shallow groundwater monitoring wells will conform to the NJDEP specifications for unconsolidated formations (shown in Appendix D of the ACO) and the deep wells will conform to the NJDEP specifications for confined, unconsolidated aquifers. Screens and risers will be factory steam-cleaned and wrapped in plastic prior to arrival at the site. Steel screens and risers may be substituted for PVC if high concentrations of organic solvents are suspected in the groundwater.

The following methods for construction of the groundwater monitoring wells referred to above are outlined below.

3.1.1 Shallow Groundwater Monitoring Wells

1 Construct the appropriate pilot hole as outlined in Section 2.2.1. Advance the subsurface boring to the desired depth by means of 6-1/4" I.D., hollow-stem auger drilling.

2 Remove center plug from augers and verify borehole depth using weighted measuring tape.

3 Add approximately one foot of washed and graded medium sand (appropriately sized for a No. 10 screen) to base of borehole.

4 Insert well screen and riser pipe into borehole through the hollow-stem augers. Top of screen must be a minimum of three feet below ground surface to allow for an adequate surface seal. This may prevent the screen from bridging the water table.

5 Add sand to screen section of well while slowly removing augers. Sand pack should extend at least 1 foot above the screen section within the borehole. Top of sand pack must be a minimum of two feet below ground surface to allow for the surface seal. Measure with weighted tape.

6 Slowly add bentonite pellet seal to borehole as augers are slowly removed. The bentonite seal will extend at least 1 foot above the top of the sand pack section, but be a minimum of one foot below ground surface. Measure with tape. The rate of removal of the auger from the borehole should closely follow the rate at which the sand pack and bentonite fill the borehole.

7 If bentonite seal is placed above the groundwater level within the borehole, add water to the borehole to hydrate the bentonite pellets. Allow pellets to hydrate at least two hours.

8 Prepare grout per specifications presented in Section 2.5.1.

9 Add grout to borehole through tremie pipe or hose from the top of the bentonite seal to two feet below ground surface (or bottom of IRM surface covering).

10 Add cement backfill to ground surface (minimum of one foot thick) or below IRM covering.

11 Patch IRM covering, if applicable, using appropriate method outlined in Sections 2.5.2 or 2.5.3.

12 Cut well riser pipe to about two inches below ground surface, if well is to have a flush-mounted protective casing (for trafficked areas). For those wells in non-trafficked areas, well riser pipe may be cut off approximately two feet above the ground surface.

13 Backfill the remainder of borehole with concrete.

14 Install flush-mount protective casing valve box with locking top over well riser pipe and set into concrete backfill for those wells in trafficked areas. Otherwise, install a six-inch I.D. (minimum) black steel protective pipe with locking cap over the riser pipe, embedded into the concrete backfill a minimum of two feet. A sloping concrete pad will then be constructed around the valve box or protective casing.

15 Etch NJDEP permit number onto the underside of the protective casing cover.

16 Install and lock protective casing cap.

17 Etch monitoring well protective casing with identification label. This information will be consistent with the numbering scheme proposed in the

sampling plan. The number will additionally be printed on the monitoring well. Record monitoring well construction details in the field notebook and copy to the project file.

3.1.2 Deep Groundwater Monitoring Wells

The deep groundwater monitoring wells will monitor the water-bearing zone below the meadow mat and above the varved clay confining layer. Since the meadow mat is a "geochemical barrier" with regard to potential downward chromium migration, it will be considered a confining layer for well installation purposes. Therefore, double-casing techniques will be used to penetrate it and thus minimize potential cross-contamination of the water-bearing zones above and below the meadow mat. Several methods are available to accomplish this according to NJDEP requirements, but one of the two following methods will be used.

Method 1:

1 Construct the appropriate pilot hole as outlined in Section 2.2.1. Advance the subsurface boring to the meadow mat by means of 12-1/4" I.D. HSA drilling. Confirm meadow mat contact by split-spoon or Shelby tube sampling methods.

2 Remove center plug from augers and verify borehole depth using weighted measuring tape.

3 Lower 8-inch black steel casing into the borehole. Support casing 12 inches from the bottom of the borehole.

4 Attach inflatable packer to the drill rods and lower into casing.

5 Prepare grout as specified in Section 2.5.1.

6 Inflate packer and pressure-grout casing in place.

7 Continue grouting until grout return is achieved. Withdraw augers as grout is added.

8 Push casing six inches into meadow mat and continue to support casing. Allow 24 hours for cement grout to cure.

Method 2:

1 Construct the appropriate pilot hole as outlined in Section 2.2.1. Advance the subsurface boring to the meadow mat by means of 6-1/4 inch I.D. by 11 inch O.D. HSA drilling. Confirm meadow mat contact by split-spoon or Shelby tube sampling methods.

2 Remove center plug from augers and verify borehole depth using weighted measuring tape.

3 Tremie cement grout into the borehole through the augers, and continue until grout return is achieved at the surface.

4 Remove HSA and allow cement grout to hold the borehole open.

5 Immediately after removing HSA from borehole, lower 8-inch steel casing into the borehole. Push casing six inches into the meadow mat.

6 Pump grout out of the casing interior or allow to set up and then drill it out. Allow 24 hours for the cement grout to cure.

After installation of the steel casing to seal off the upper water-bearing zone, the following procedures will then be used to penetrate the meadow mat and install the well in the lower water-bearing zone.

1 Continue to advance borehole using 6-inch O.D. hollow-stem augers to desired depth.

2 Remove center plug from augers and verify borehole depth using weighted measuring tape.

3 Add approximately one foot of washed and graded medium sand (appropriately sized for selected screen) to base of borehole.

4 Decontaminate (steam clean) all well screens and risers on-site prior to placement in borehole.

5 Thread sections of well screen and riser pipe together and insert into borehole through the hollow-stem augers. Well screen length may need shortening if a five (5) foot screen cannot be installed due to the small thickness of the water-bearing zone below the meadow mat.

6 Add sand to screen section of well while slowly removing augers. Sand pack should extend at least one foot above the screen section within the borehole. Measure with weighted tape.

7 Slowly add bentonite slurry seal to borehole as augers are slowly removed. The bentonite seal should extend at least one foot above the top of the sand pack section. Measure with tape. The rate of removal of the auger from the borehole should closely follow the rate at which the sand pack and bentonite fill the borehole. When bottom of casing is reached, remove augers.

8 Prepare grout per specifications presented in Section 2.5.1.

9 Add grout to borehole through tremie pipe or hose from the top of the bentonite seal to two feet below ground surface (or bottom of IRM surface covering).

10 Add cement backfill to ground surface or below IRM covering.

11 Patch IRM covering, if applicable, using appropriate method outlined in Sections 2.5.2 or 2.5.3.

12 Cut well riser pipe to about two inches below ground surface, if well is to have a flush-mounted protective casing (for trafficked areas). For those wells in non-trafficked areas, well riser pipe may be cut off approximately two feet above the ground surface.

13 Backfill the remainder of borehole with concrete.

14 Install flush-mount protective casing valve box with locking top over well riser pipe and set into concrete backfill for those wells in trafficked areas. Otherwise, install a 6-inch I.D. (minimum) black steel protective pipe with locking cap over the riser pipe, embedded into the concrete backfill a minimum of two feet.

15 Etch NJDEP permit number onto the underside of the protective casing cover.

16 Install and lock protective casing cap.

17 Etch monitoring well protective casing with identification label. Record monitoring well construction details in the field notebook and copy to the project file.

3.1.3 Bedrock Monitoring Wells

The bedrock monitoring wells will monitor the upper-most water-bearing zone of the bedrock aquifer. Since a shallow overburden zone is anticipated overlying the bedrock, steel casing will be used to "seal off" the overburden from the bedrock to prevent cross-contamination. The following method will be used in installing bedrock monitoring wells.

1 Construct the appropriate pilot hole as outlined in Section 2.2.1. Advance a sixteen inch (minimum) boring to the top of the meadow mat by means of the mud rotary method.

2 Remove drill bit and rods and verify borehole depth using weighted measuring tape.

3 Lower 12-inch black steel casing into the borehole.

4 Prepare grout as specified in Section 2.5.1.

5 Using a tremie pipe, pump the grout mixture until grout return is achieved. Allow 24 hours for grout to cure.

6 Advance a 12-inch boring through the 12-inch casing to the top of the varved clay using the mud rotary method.

7 Remove drill bit and rods and verify borehole depth using weighted measuring tape.

8 Lower 8-inch black steel casing into the borehole.

9 Prepare grout as specified in Section 2.5.1.

10 Using a tremie pipe, pump the grout mixture until grout return is achieved. Allow 24 hours for grout to cure.

11 Once the grout has cured ream the borehole to rock using a 6-inch drill bit and the air rotary method.

12 Begin rock coring as outlined in Section 2.2.5.

13 Advance rock core in 5-foot runs until the first significant fracture or network of fractures is identified.

14 Ream the core hole to a 6-inch diameter to a depth of approximately 5 feet below the first significant fracture or fracture network.

15 All well screens and risers will be steam cleaned on-site prior to well installation.

16 Thread five foot sections of well screen (20 slot) and riser pipe together and insert into borehole, making sure that screen is set within the fracture zone.

17 Add Morie No. 1 sand or equivalent to screen section of well. Sand pack should extend at least one foot above the screen section within the borehole. Measure with weighted tape.

18 Slowly add bentonite pellets to borehole. This seal should be 1-2 feet in thickness overlying the sand pack.

19 Prepare grout per specifications in Section 2.5.1.

20 Add grout to borehole through tremie pipe or hose from the top of the bentonite seal to two feet below ground surface (or bottom of IRM covering).

21 Add cement backfill to ground surface or below IRM covering.

22 Finish well as previously outlined for deep monitoring wells.

23 Patch IRM covering if applicable, using appropriate methods outlined in Sections 2.5.2 through 2.5.3.

3.1.4 Sealing and Abandoning of Groundwater Monitoring Wells

Existing monitoring wells, installed during investigations performed in the past, will be inspected to assess their usefulness for the planned RI activities. Upon receiving authorization from NJDEP, monitoring wells whose integrity has been compromised or whose usefulness is marginal, will be abandoned and sealed using the method described below by a NJ-Certified Well Sealer. A record of this abandonment and sealing will be made and included in the RI report. Well Abandonment Forms will be filed with the Bureau of Water Allocation.

1 Prepare grouting material with the following specifications:

- 8 gallons of potable water
- 5 pounds of bentonite powder
- 94 pound bag of cement

2 Calculate the volume of well based on the best available information of well construction records and add 10% to that volume. Determine the volume of grout to be emplaced.

3 Mix the grout to be emplaced.

4 Record the type and amount of materials used during the mixing operation. Check to verify that the ratios are within specification tolerance.

5 Place tremie pipe near bottom of monitoring well and begin pumping the grout.

6 Continue pumping until return circulation of grout is observed.

7 Remove surface casing, if feasible, and tremie pipe. If removal of casing is not feasible or practical, saw off the well casing about 6 inches below grade.

8 Top off and clean surface near the well. Level the ground to about the pre-existing grade. Add grout or cement as necessary to the area near the well.

9 Make a follow-up check at each abandoned well within 7 to 10 days of completion. Document the visit and record any action taken.

3.2 MONITORING WELL DEVELOPMENT PROCEDURES

Following completion of drilling and well installation, each monitoring well will be developed in order to remove formation fines from the vicinity of the well screen and assure good hydraulic communication with the water-bearing zone. A combination of overpumping/pumping along with bailing/surging will be utilized to develop the newly installed monitoring wells.

1 The well cover will be unlocked and carefully removed to avoid having foreign material enter the well. Well volume will be calculated using the formula given in Section 5.2.1. The interior of the riser pipe will be monitored for organic/combustible vapors using a photoionization detector (PID) and a combustible gas indicator (CGI). If a PID reading of greater than 5 ppm is recorded, appropriate personal protection upgrades will be made in accordance with the HASP. If a CGI reading indicates combustible gases are present over 10% of the Lower Explosive Limit (LEL), work will cease immediately until the gases have vented.

2 Using an electronic water level indicator, the water level below the top of casing will be measured (from the permanent measuring point marked on the top of casing) and recorded in the field logbook.

3 Decontaminate the water level indicator as outlined in the EDP.

4 Insert two-inch submersible pump with attached pump tubing or tubing from centrifugal pump into well casing to a point just off the bottom of the well.

5 Turn system on and begin well evacuation. Monitor well drawdown so that tubing or pump intake remains below water surface. Adjust pumping rate to maintain equilibrium between recharge rate and evacuation rate. If well recovery is excessively slow, so that equilibrium between pumping and recharge rates can not be maintained, pump well to near dryness, let it recover the necessary time, and repeat the pumping process. Agitate water in the well by raising and lowering tubing or pump. This will help to suspend sediments and impart a reciprocating flow through the well screen. In addition, for slow recharge wells, a PVC bailer may be used instead of the pumps as a surge block to agitate the water, clean out the filter pack material and remove the sediment laden water from the well bore.

6 Continue development for a minimum of one hour or until a "turbidity-free" discharge is attained whichever is less.

7 For each successive well volume evacuated, obtain a sample for pH, ORP, DO conductivity, turbidity and temperature measurements.

8 Record field measurements (pH, ORP, DO, conductivity, turbidity and water temperature), volume of water evacuated (using a graduated bucket), and any other comments in the field logbook.

9 The collection and disposal of development water shall follow the procedures outlined in Section 6.2. The development water will be allowed to discharge to the ground based on field visual determination.

3.3 MEASUREMENT OF GROUNDWATER ELEVATION/NAPL THICKNESS

Water levels/non-aqueous phase liquid (NAPL) thickness (if present) in on-site monitoring wells will be measured using an electronic oil/water interface probe such as a Heron Instruments H_2Oil Interface Probe. Initially, measurements will be taken periodically during the field investigation at the site, prior to, and following well development, until the well has recovered to static conditions. Water levels/NAPL thickness (if present) will then be measured prior to each groundwater sampling event. Water level/NAPL thickness measurement procedures are presented below.

1 Decontaminate oil/water interface probe as outlined in the EDP. Confirm identification of the monitoring well by checking the stamped (or etched) ID beneath the protective casing cover. Note: If the well appears different than in previous events (e.g., visible damage, lock not secured, etc.), record difference in field logbook.

2 Lower probe slowly into the monitoring well until audible alarm indicates water or light non-aqueous phase liquid (LNAPL). Should the probe indicate the presence of LNAPL continue to slowly lower the probe until the probe indicates water. Record thickness of LNAPL in the field logbook.

3 Read depth to the nearest 0.01 foot from the graduated cable using the etched survey point on the monitoring well riser as the reference.

4 Repeat the measurement for confirmation and record the water level/LNAPL thickness. If a discrepancy of more than 0.02 feet is noted between measurements, remeasure a third time to obtain a consistent measurement. Record all readings in field logbook.

5 Slowly lower the probe towards the bottom of the groundwater monitoring well to determine whether dense non-aqueous phase liquid (DNAPL) is present. Should DNAPL be present, determine thickness using procedure outlined above.

6 Remove the probe from the monitoring well slowly, drying the cable and probe with a clean "Chem Wipe" or tissue while using the appropriate Personal Protective Equipment (PPE) as denoted in the HASP. Note any anomalies encountered, such as excessive sediment on the probe or an oily film.

7 Replace monitoring well cap and lock protective cap in place.

8 Decontaminate the oil/water interface probe (per procedures in EDP) so it is ready for subsequent measurements.

3.4 PERMEABILITY TESTING

Slug tests will be performed on each newly installed groundwater monitoring well to obtain in-situ hydraulic conductivity data. Tests will be logged on an In-Situ, Inc. Troll™ or equivalent. The detailed procedure for permeability testing is outlined below. Well construction details should be reviewed before conducting the slug test so that the procedure is implemented appropriately at each monitoring well.

1 Measure dimensions of the slug to be used to displace water in the monitoring well. Predetermine volume of water which will be displaced and corresponding initial water level change which will occur when the slug is added or removed from the well. Record slug dimensions and volume calculations in field logbook.

2 Decontaminate water level indicator, data logger probe, cable, slug, and line (rope), following decontamination procedures outlined in the EDP.

3 Measure the static water level in the monitoring well and record in the field logbook (only monitoring wells which have fully recovered to static level conditions should be tested). Determine the initial-response water level based on Step 1 and record in field logbook.

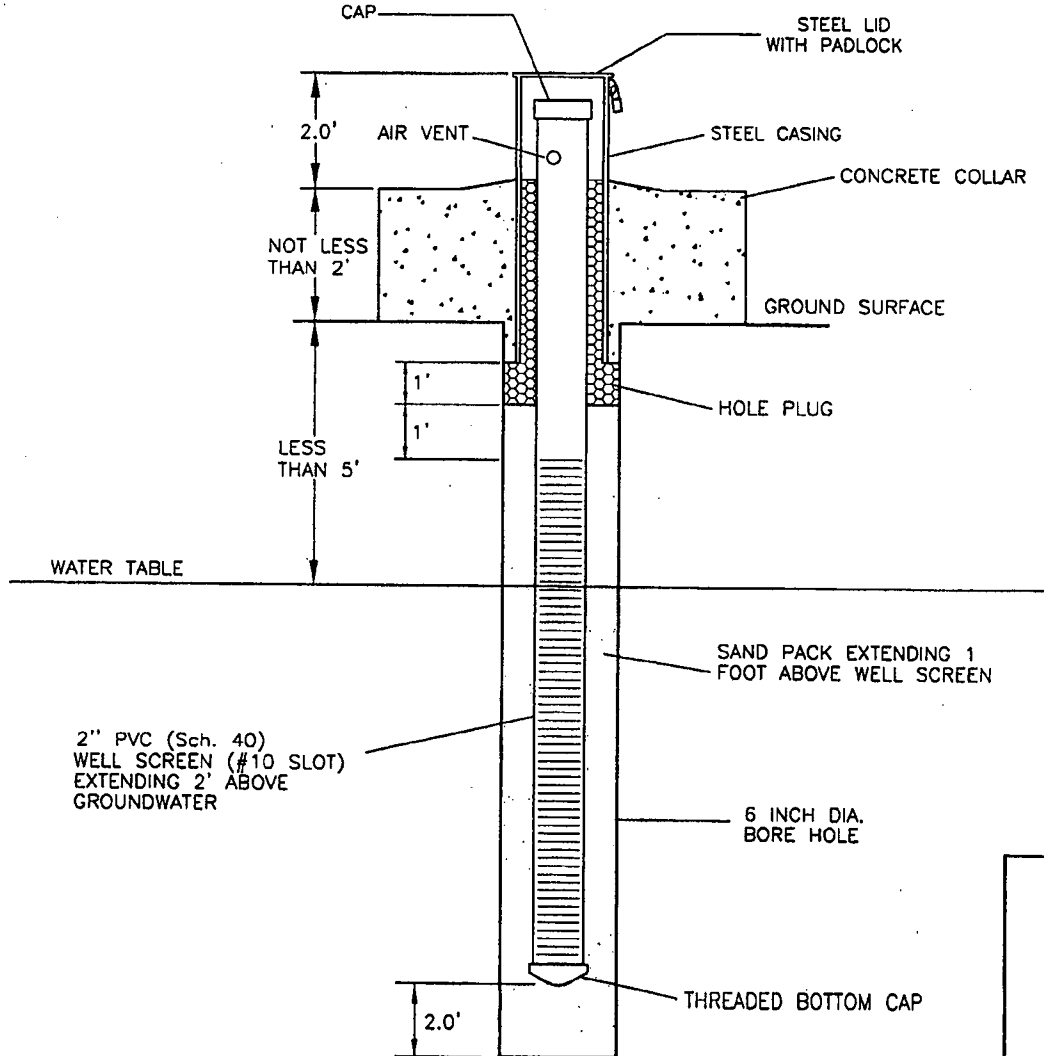
4 Set up data logger with precleaned (decontaminated) pressure transducer and cable. Insert transducer and allow static level to stabilize. Input necessary functions to logger, including monitoring well identification, date, static level, and number of time intervals and their durations for measurement.

5 Insert (or withdraw) the slug and quickly activate the data logger. Continue test until a minimum of 90% recovery (to the static water level) is achieved. Conduct a falling head test (insert slug), followed by a rising head test

(withdraw slug) on each monitoring well. The results can then be employed to derive estimates of formation hydraulic conductivity. Each test will constitute an independent measure of hydraulic conductivity.

6 Stop the data acquisition program, disassemble and decontaminate testing equipment.

7 Remove recorded chart from data logger and check date, time, presence of results, and calibration.



NOT TO SCALE

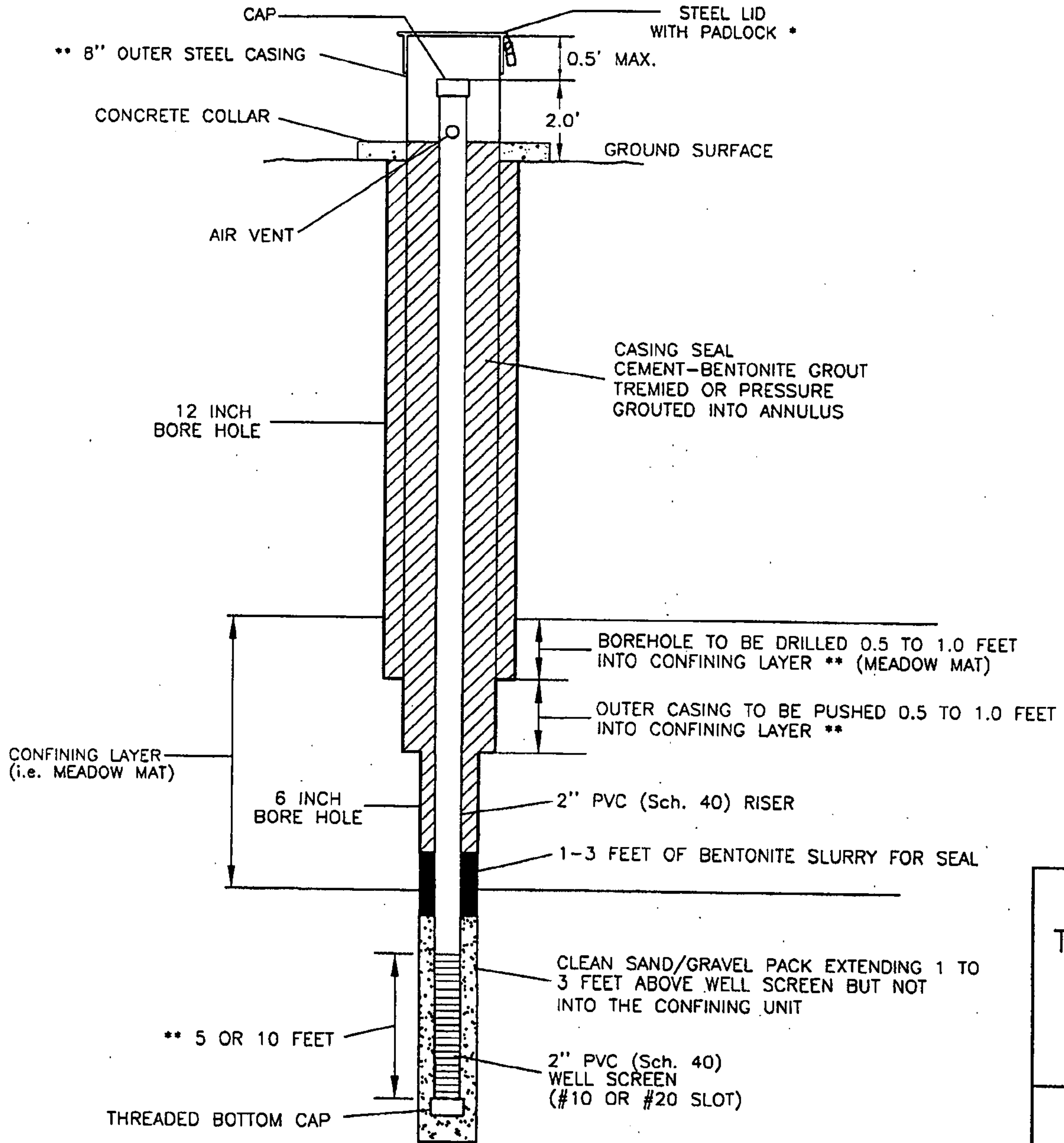
FIGURE 3-1

TYPICAL SHALLOW MONITORING WELL DETAIL

STANDARD CHLORINE
SITE NO. 116
KEARNY, NEW JERSEY

BROWN AND CALDWELL Mahwah, New Jersey

RI116-16 06/06/01 PLOT 1=1 (RI116-16.PCP)



* FLUSH MOUNTED CASING MAY BE SUBSTITUTED AS PER NJDEP MONITORING WELL REQUIRMENTS.
** TO BE FIELD DETERMINED DEPENDING ON SUBSURFACE CONDITIONS

NOT TO SCALE

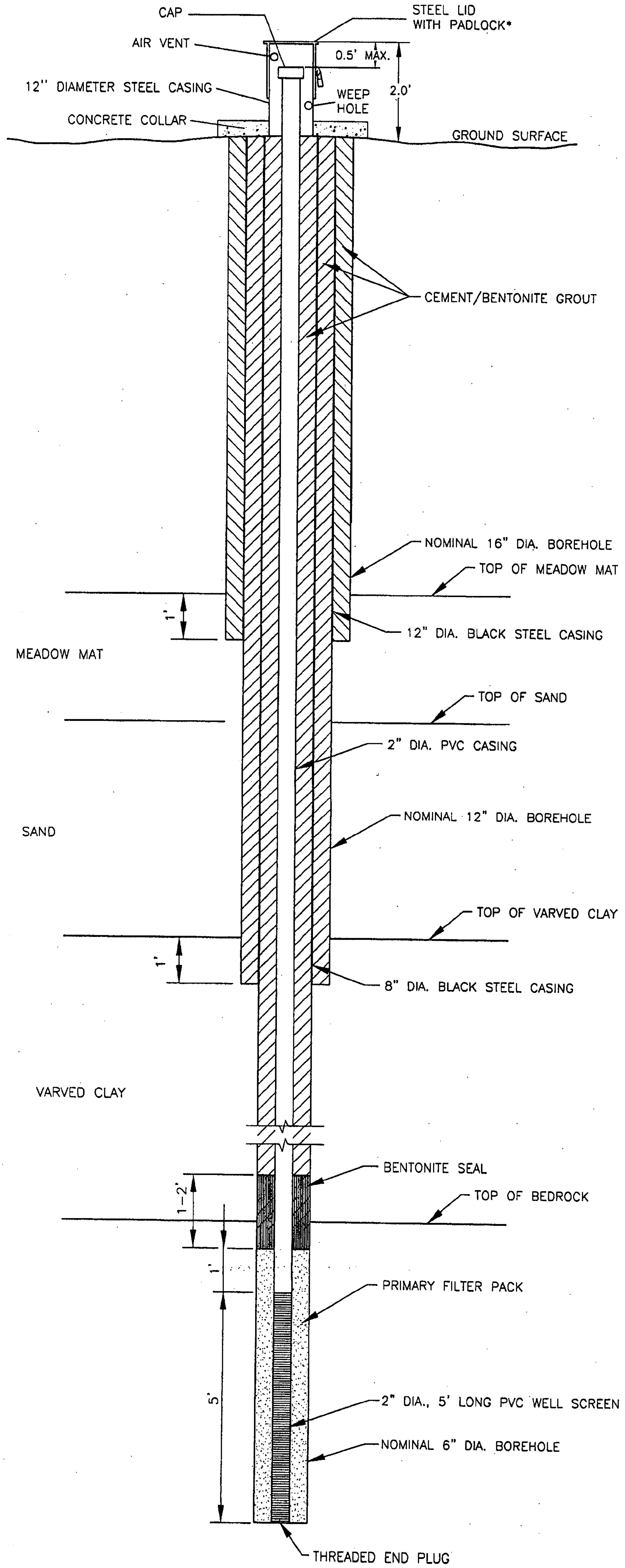
FIGURE 3-2

TYPICAL DOUBLE CASED DEEP MONITORING WELL DETAIL

STANDARD CHLORINE
SITE NO. 116
KEARNY, NEW JERSEY

BROWN AND CALDWELL Mahwah, New Jersey

RI116-17 06/07/01 PLOT 1=1 (RI116-16.PCP)



* FLUSH MOUNTED CASING MAY BE SUBSTITUTED AS PER NJDEP MONITORING WELL REQUIRMENTS.

NOT TO SCALE

FIGURE 3-3

TYPICAL BEDROCK MONITORING WELL DETAIL

STANDARD CHLORINE
SITE NO. 116
KEARNY, NEW JERSEY

BROWN AND CALDWELL Mahwah, New Jersey

RI116-18 06/07/01 PLOT 1=1 (RI116-18.PCP)

4.0 SURVEY OF SAMPLE LOCATIONS

Locations of sampling points and groundwater monitoring wells will be determined. Soil, sediment, and surface water sampling points, will be located through the use of tape measurements from physical features. Monitoring well locations will be surveyed under the direction of a New Jersey-licensed surveyor. Horizontal control for these well locations will be tied into the New Jersey State Plane Coordinates. Vertical control will be tied to the North American Vertical Datum of 1983 (NGVD 1983). The following methods will be utilized when locating the respective sampling or monitoring points.

4.1 SURVEY OF SOIL BORINGS, SEDIMENT, AND SURFACE WATER SAMPLING POINTS

Sampling points will be located horizontally by measuring distances to two or more nearby permanent physical features, such as telephone poles, building corners, etc. These reference locations will subsequently be referenced to the site base map.

Elevations of original ground surface (or pavement) for the soil boring locations will be determined under the direction of a New Jersey-licensed surveyor after each set of planned borings has been completed on-site.

4.2 SURVEY OF MONITORING WELLS

Each monitoring well will be surveyed vertically to the nearest 0.01 foot above mean sea level and horizontally to an accuracy of approximately 0.1 foot, using conventional surveying techniques. This level of accuracy will more than satisfy NJDEP requirements. A permanent water-level measurement mark will be etched onto the well casing to allow for accurate reproducible water-level measurements over time. The surveyor will complete NJDEP Form B - Monitoring Well Location Certification, and submit the form to NJDEP for each completed well.

5.0 SAMPLE COLLECTION PROCEDURES FOR CHEMICAL ANALYSIS

5.1 SOILS/COPR

Soil samples (including fill materials and COPR samples) will be collected for classification and physical testing purposes using the investigation procedures outlined in Section 2.0. This section discusses the procedures for collecting a sample for chemical analysis at the intervals specified in the RIWP.

Near-surface and subsurface soil samples will be obtained using either a split-spoon sampler or GeoProbe® sampler as outlined in Section 2.2.3 or 2.3, respectively. The detailed procedure is outlined below:

1 Open split-spoon or acetate liner as described in Section 2.2.3 or 2.3, respectively.

2 Inspect soil sample. Record any physical characteristics (e.g., obvious contamination, odor, or discoloration) in the field logbook.

3 If samples are to be collected for volatiles and/or semi volatiles, immediately remove appropriate sample volume from the sampler and place in appropriate jar.

4 Place remainder of sample in a decontaminated mixing bowl (steel) and thoroughly mix soil until a consistent physical appearance is achieved.

5 Transfer sample to a laboratory prepared (I-Chem Series 300 or equivalent) sample container.

6 Decontaminate sampling implements after use and between sample locations using procedures outlined in the EDP.

7 Record field sampling information in the field logbook as outlined in Section 5.7.1.

8 Label each sample container with the appropriate sample identification data as outlined in Section 7.1.3 and place sample in a cooler for shipment to the laboratory.

9 Initiate chain-of-custody procedures, as outlined in Section 7.1.3.

5.2 GROUNDWATER MONITORING WELLS

5.2.1 Well Purging Procedures

Before collecting a representative groundwater sample, monitoring wells must be purged in accordance with N.J.A.C 7:14A-10.4 (revised February 4, 1997) and the U.S. Environmental Protection Agency-Region II Standard Operating Procedure "Groundwater Sampling Procedure Low Stress (Low Flow) Purging and Sampling" (March 16, 1998). Groundwater wells will be purged at a rate of 200 to 500 ml per minute until three consecutive indicator readings are within the following ranges of each other:

± 0.1 for pH

± 3% for conductivity

± 10 mv for redox potential (ORP)

± 10% for DO and turbidity

Should poor recovery be an issue, the well will be pumped and allowed to recover until a sufficient volume has flowed into the well for sampling. Pumping rates will be adjusted depending upon the recovery rate of each well.

Equipment List (Typical):

- Pumping equipment
- 3/8" polyethylene dedicated tubing
- Field instrumentation (PID, Horiba or equivalent)
- Field logbook
- Monitoring well lock keys
- Water level indicator
- Graduated bucket

1 Unlock the well cover and carefully remove it to avoid having foreign material enter the well. Monitor the interior of the riser pipe for organic vapors using a photoionization detector. If a reading of greater than 5 ppm is recorded, vent the well until levels are below 5 ppm before pumping is conducted. In addition, monitor the interior of the riser pipe using a CGI. If readings of greater than 10% LEL are encountered, vent the well until levels are below 10% LEL before proceeding.

2 Using an electronic water level indicator, measure the water level below top of casing (from permanent marked point). Determine the volume of water in the well using the following formula:

$$\text{Volume} = 5.8752 * C^2 * H$$

Where C = casing diameter in feet

H = Height of water column in feet

3 Decontaminate the water level indicator between each monitoring well as outlined in the EDP.

4 Measure and cut a 3/8" polyethylene suction hose to a length equal to the total casing length plus 5 feet. Insert tubing into well casing to just below the ground water surface.

5 Attach tubing to pump and begin evacuation. Monitor the water level drawdown so that tubing end remains below the water surface. Adjust pumping rate to maintain equilibrium between recharge rate and evacuation rate, if possible. If the water level drops, gently (to minimize generation of turbidity) lower the tubing as needed to maintain flow. Pumping from the bottom of the water column is intended to flush the well. Continue pumping until the field indicator parameters are stabilized..

6 Every five minutes collect indicator readings for the parameters listed above.

7 Collect all well purge water as outlined in Section 6.2.

8 Close protective cap and lock protective casing.

9 Record well purging data in the field logbook. Record additional field information as outlined in Section 5.7.1.

5.2.2 Groundwater Sampling Procedures

The first round of groundwater monitoring well sampling will be performed a minimum of two weeks and not more than 30 days after the development of each set of groundwater monitoring wells on-site. Well sampling will be performed on the same day as purging of the well, after the well has recovered sufficiently to sample, preferably within two (2) hours after evacuation. The only exception to the two (2) hour criterion will be for those slow recovery wells where insufficient sample has accumulated to sample within the required two hours. For these wells, sample collection will take place as soon as the required sample volume can be feasibly collected.

Equipment List (Typical):

- Peristaltic pump (capable of low flow) or steel or Teflon® bailers
- 3/8" polyethylene dedicated tubing
- Water level indicator
- Sample bottles and appropriate preservatives
- Field instrumentation (PID, Horiba or equivalent)
- Water filtration apparatus with a 0.45 micron filter
- Field logbook
- Chain-of-custody forms, labels, coolers with blue ice (or water ice)
- Plastic sheeting
- Monitoring well lock keys
- Decontamination supplies (see EDP)

1 Prior to collection of groundwater samples from the monitoring wells, each monitoring well must first be measured for level (and recorded in field logbook) and purged according to the procedures shown in Section 5.2.1.

2 Within two (2) hours of monitoring well purging, if the well has recharged enough to sample, samples will be collected into appropriate containers using the peristaltic pump and dedicated tubing used to purge the monitoring well.

3 Using an electronic water level indicator, the water level below top of casing (from the etched mark) will be measured and recorded. Compare water level

with water level prior to purging to determine if water level has stabilized (not necessary for sampling, but desirable).

4 Collect groundwater sample in appropriately prepared (I-Chem Series 300 or equivalent) containers (containing appropriate preservatives, if required) directly from pump discharge tube. Samples for VOC analysis, if required, should be filled first (using a bailer), leaving no head space in the VOA container. Samples for metals will be field filtered. All other containers should be filled to the shoulder of the container.

5 Record well sampling data in the field logbook. Record additional field information as outlined in Section 5.7.1.

6 Close and lock protective casing.

7 Label each sample container with the appropriate sample identification data as outlined in Section 7.1.3 and place in coolers for transport to the on-site command office for processing (e.g., packing and documentation) prior to shipment to the analytical laboratory.

8 Initiate chain-of-custody procedures as outlined in Section 7.1.3.

A second round of groundwater monitoring well sampling (if required) will be performed after the first round analytical results have been evaluated, but no sooner than 30 days from the date of the first round of sampling, using procedures described above.

5.2.3 NAPL Sampling Procedures

This procedure will be used for the sampling of NAPL at COPR Site 116. The procedure for each well is as follows:

Equipment List (Typical):

- Oil/water interface probe
- Disposable Teflon® bailer equipped with a bottom check valve
- Sample bottles and appropriate preservatives
- In-line disposable filter – 0.45 micron
- Field instruments
- Field logbook
- Chain-of-Custody forms, labels, coolers with ice
- Plastic sheeting
- Monitoring well lock keys
- Decontamination supplies (see EDP)
- Appropriate PPE
- Chemwipes/towels

Collection of LNAPL samples

Obtain a sample of LNAPL, if present, using a disposable Teflon® bailer equipped with a bottom check valve as follows:

1. Note the depth of the water/LNAPL interface from the interface probe measurement.
2. Slowly lower the bailer to a depth no more than six (6) inches below this measured depth.

Particular care should be taken to minimize disturbance of the water column below the LNAPL layer (if present).

3. Remove the bailer and record the thickness, if present, of LNAPL in the bailer. Discard the contents of the bailer if LNAPL is not obviously present in the bailer.

4. Transfer LNAPL to the appropriate sample container(s), if present, using a bottom emptying device. It should be noted that the bottom emptying device will need to be used to bleed off any water present in the bailer, prior to collecting a LNAPL sample.

Collection of DNAPL samples

Obtain a sample of DNAPL with the use of a disposable Teflon® bailer equipped with a bottom check valve, as follows:

1. Slowly lower the bailer to the bottom of the well.

2. Let the bailer stand for a minimum of five (5) minutes to allow the DNAPL thickness, if present, to equilibrate within the bailer.

3. Remove the bailer and record the thickness, if present, of DNAPL in the bailer. Discard the contents of the bailer if DNAPL is not obviously present in the bailer. It should be noted that if LNAPL is also present in the well, it may have to be wiped off the outside of the bailer.

4. Transfer DNAPL to the appropriate sample container(s), if present, using a bottom emptying device.

5. If the DNAPL thickness can not be determined, record the length of the water column in the bailer and pour the contents of the bailer into a one liter glass container.

6. Record the length of the water column in the glass container and allow it to settle for a minimum of 12 hours.

7. Observe and record the presence and thickness of DNAPL in the container.

8.Transfer DNAPL from the one liter container to the appropriate sample container(s).

5.3 IN-SITU GROUNDWATER SAMPLING USING GEOPROBE® SAMPLERS

Once a boring has been advanced using the GeoProbe®, an in-situ groundwater sample may be collected for field-screening purposes in accordance with the following procedures.

A new, pre-cleaned, factory manufactured slotted PVC screen will be placed down the hole. Dedicated tubing will then be inserted into the well until it is several inches from the bottom. A peristaltic pump with dedicated silicon tubing will then be attached to the tubing. The well will be purged for approximately one hour or until the discharge is clear, whichever is shorter. (Due to the nature of this technique, the turbidity of the grab sample may not significantly improve over time.) Purge water will be containerized and preferably disposed of on-site if the field leader deems that the following criteria have been met:

- The surface soils are known to be contaminated, and
- The disposed water will not run off-site, and
- There is no potential to contaminate an uncontaminated aquifer, and
- There is no potential to create a health hazard through airborne exposure, and
- The discharge will not impact that quality of groundwater samples or an ongoing slug test.

If these conditions cannot be met, the purge water will be containerized for subsequent characterization and disposition at an appropriate facility.

Sample containers for total Cr and Cr(VI) analysis will be filled in the following order:

1. Unfiltered Cr(VI)
2. Unfiltered total Cr
3. Filtered Cr(VI)
4. Filtered total Cr

The groundwater samples for inorganic analyses will be filtered using an in-line 0.45 micron quick filter. At least 100 ml of groundwater will be passed through the filter before the groundwater is collected in the appropriate containers. However, if the groundwater is very turbid, this process may not be feasible due to the premature clogging of the filter. In this instance, the volume of water passed through the filer will be reduced as necessary or a pre-filter will be used.

5.4 SURFACE WATER

Surface water samples will be collected by direct submersion of the precleaned sample container (preferred method) or by extendable pond sampler. All surface water samples will be grab samples. Where samples are collected from deep water bodies (Hackensack River), the water sample will be collected from the mid-point depth using a weighted bottle sampler. In flowing water bodies (Hackensack River and select drainage ditches), sampling will commence from downstream locations, moving to upstream locations. For tidal waterways, surface waters should be collected at predetermined times and off-shore locations associated with the tidal cycle, depending on the objectives of the sampling event. Tide charts should be consulted prior to a day's sampling event to select the desired time interval and location (relative to mean high or low tide) for surface water sampling.

If a sediment sample is to be collected at the same location as a surface water sample, the water sample will be collected first, and then the sediment sample. For standing water, the sample will be collected from just below the surface. The following methodologies will be used to collect surface water samples, depending on the location of the sample point.

5.4.1 Near-Shore Water Samples

Near shore surface water samples will be collected from the bank or by wading. Appropriate precautions will be taken for personal safety in accordance with the project HASP.

Equipment List (Typical)

- Pond sampler with extendable boom
- Assorted ring clamps (e.g., 4", 6" and 8" diameter clamps)
- Horiba or equivalent
- Sample labels, chain-of-custody forms, coolers
- Sample bottles with appropriate preservatives

1 Assemble the pond sampler for collection of samples. Make sure that the sampling beaker and the bolts and nuts that secure the clamp to the pole are tightened properly. If pond sampler is not needed, direct submersion of the sample containers may be employed.

2 Take a grab sample by slowly submerging the sample container with minimal surface disturbance to the desired depth (mid-depth for flowing water, just below the surface for standing water).

3 Retrieve the pond sampler or sample container from the surface water with minimal disturbance.

Note: Steps 4 through 6 are not needed if direct submersion of the sample container is used.

4 Remove the cap from the sample container and slightly tilt the mouth of the sample container below edge of the device to allow pouring of sample into sample container.

5 Empty the sampler slowly into the predesignated sample container, allowing the sample stream to flow gently down the side of the container with minimal entry turbulence.

6 Continue delivery of the sample until the container is filled.

7 In the same manner, fill all required sample containers and preserve the sample, as required.

8 Secure the appropriately lined, e.g., Teflon®, cap tightly.

9 Measure pH, ORP, DO, conductivity and water temperature on a separate aliquot of the sample or by direct immersion of the probes, if feasible.

10 Decontaminate the sampling container or attach another sample container prior to sampling at the next location.

11 Record all field information as described in Section 5.7.1.

12 Label each sample container with the appropriate sample identification as outlined in Section 7.1.3 and place sample in a cooler for shipment to the laboratory.

13 Initiate chain-of-custody procedures, as outlined in Section 7.1.3.

5.4.2 Off-Shore Water Samples

This section addresses the collection of samples from off-shore locations. Appropriate precautions will be taken for personal safety in accordance with the project HASP.

Equipment List (Typical)

- Small boat or barge with life preservers (one for each occupant)
- Weighted bottle sampler
- 1/4" nylon line
- 100' measuring tape
- Horiba or equivalent
- Sample labels, chain-of-custody forms, coolers
- Sample bottles with appropriate preservatives
- Anchor
- Brunton compass

1 Position boat or barge at the sampling point. Anchor in this location, if possible. Using a weighted tape, obtain depth of water. Determine mid-point water depth.

2 Assemble the weighted bottle sampler. Attach 1/4" dedicated nylon line to the sampler and mark line with mid-point depth. Attach free end to boat.

3 Lower sampler to the predetermined depth (mid-depth for flowing water, just below the surface for standing water).

4 When sampler is at required depth, pull out bottle stopper with a sharp jerk of the sampler line and allow the bottle to fill completely.

5 Retrieve sampler.

6 Remove the cap from the sample bottle and slightly tilt the mouth of the bottle below the sampler (to allow for pouring sample into the sample container).

7 Empty the sampler slowly, allowing the sample stream to flow gently down the inside of the container with minimal entry turbulence.

8 Continue delivery of the sample until the container is completely filled.

9 In the same manner, fill all required sample containers and preserve the samples, as required.

10 Secure the appropriately lined, e.g., Teflon®, cap tightly.

11 Measure pH, ORP, DO, conductivity, and water temperature of the sample (use a separate aliquot).

12 Record field information in the field book as described in Section 5.7.1.

13 Label each sample container with the appropriate sample identification as outlined in Section 7.1.3 and place sample in a cooler for shipment to the laboratory.

14 Initiate chain-of-custody procedures, as outlined in Section 7.1.3.

15 To allow for location of the sampling point on a map, use a Brunton compass to determine compass bearings to two (preferably three) permanent nearby physical features on the shore and record in the field logbook. This will allow the sample location to be accurately located on a map. Alternatively, the sampling location may be determined by survey persons located on shore at the time of sampling, who will establish compass bearings to the sampling location from two or more physical features on shore. This will allow subsequent triangulation to designate the location on a map.

5.5 SEDIMENT

Sediment samples will be collected from the same locations as the surface water samples (and possibly some locations without water samples), but after collection of the surface water samples, using the following sampling instruments:

1 Standing water or shallow stream sediment samples will be collected with a steel scoop. This method is only appropriate for shallow samples where water depth is less than four (4) inches.

2 A Ponar dredge (or corer) will be used when water depth is greater than four (4) inches or the water is flowing.

3 If a shallow subsurface sample is desired, a steel (e.g., garden-type) shovel will be used to remove the upper sediments to the desired depth and the sample will be collected with a steel lab-type spoon.

5.5.1 Near-Shore Sediment Samples

It is anticipated that sediment samples will be collected for this RI near shore, from the bank or by wading, using the following equipment and procedural outline:.

Equipment List (Typical)

- Steel lab spoon/scoop
- Steel mixing bowl
- Sample labels, chain-of-custody forms, coolers
- Sample containers with appropriate preservatives

1 Collect surface water sample first, if needed. Using a precleaned steel scoop (if a shallow, standing water sample; see Section 5.5 above), collect a sediment sample (to desired depth, usually the top few inches) and place into appropriate sample container. If water is flowing or greater than four (4) inches deep, use a Ponar dredge (or corer) to obtain sample. Procedures for sampling with a Ponar dredge are described below in Section 5.5.2.

2 If a subsurface sample is desired, remove sediment to the desired depth with a decontaminated steel shovel. Then use a decontaminated steel scoop to collect the required samples.

3 Secure a Teflon® -lined cap onto the container.

4 Decontaminate equipment after use and between sample locations using procedures outlined in the EDP.

5 Record all field data in the field logbook as prescribed in Section 5.7.1.

6 Label each sample container with the appropriate sample identification as outlined in Section 7.1.3 and place sample in a cooler for shipment to the laboratory.

7 Initiate chain-of-custody procedures, as outlined in Section 7.1.3.

5.5.2 Off-Shore Sediment Samples

This method addresses the collection of sediments from offshore locations. Appropriate precautions will be taken for personal safety in accordance with the project HASP. Use of a Ponar dredge, as described in Section 5.5.1 for the collection of near-shore samples, is applicable for offshore sediment sample collection.

<u>Equipment List (Typical)</u>

- Small boat or barge with life preservers (one for each occupant)
- Ponar dredge
- 1/4" nylon line
- 100' measuring tape
- Plastic mixing bowl, laboratory steel spoon
- Sample labels, chain-of-custody forms, coolers
- Sample containers with appropriate preservatives

1 Collect surface water first, if specified at same location. Attach a decontaminated Ponar dredge to the necessary length of sample line. It should be noted that due to the presence of stainless steel within the ponar dredge, a field blank will be required and will be analyzed for both Cr(VI) and total Cr.

2 Measure and mark the distance to the bottom on the sample line. Place a second mark, two feet shallower, which will indicate the proximity to the bottom so that

the lowering rate may be reduced at this point, minimizing bottom sediment disturbance.

3 Open sampler jaws until latched. Support sampler by the lift line.

4 Tie free end of sampler line to the boat or barge to prevent accidental loss of sampler.

5 Lower sampler until mark on sample line is reached. Use a slow rate of descent through the last two feet until contact with the bottom is reached.

6 Slowly raise dredge to surface.

7 Place sampler in a steel mixing bowl and open sampler.

8 Obtain sample from bowl with a steel lab-type spoon and place in appropriate sample containers.

9 Decontaminate sampler after use and between sample locations using procedures outlined in the EDP.

10 Record all field data in the field logbook as prescribed in Section 5.7.1.

11 Label each sample container with the appropriate sample identification as outlined in Section 7.1.3 and place sample in a cooler for shipment to the laboratory.

12 Initiate chain-of-custody procedures as outlined in Section 7.1.3.

5.6 AIR

An air monitoring program has been previously carried out. No additional air monitoring specifically directed toward measuring chromium levels is planned under this RIWP. However, while performing intrusive activities in the vicinity of the lagoon area, air monitoring will be conducted for the purpose of fulfilling the requirements of the HASP.

5.7 GENERAL DOCUMENTATION REQUIREMENTS

5.7.1 Field Logbook

Field activities, including drilling and sampling, will be documented daily in bound logbooks with pre-numbered pages. These books are to accompany the samplers to each sample location. Maintenance and legibility of the field logbooks is the responsibility of each sampler. Logbook entries will be made in indelible ink. All changes to field notes will be initialed in ink. Each page will additionally be signed by the respective sampler on the day it is completed. Information to be recorded during environmental sampling activities shall include such items as:

- Name of site and type of sample
- Purpose of sampling (i.e. monitoring, sample collection)
- Sample number, volume, and description
- Procedure performed during sampling
- Sampling location, including sketch with measurements to physical features (see Section 4.1)
- Date and time of each sampling event
- Sampler name(s)
- Field instrument calibration information
- Field measurements such as pH, ORP, DO, temperature and conductivity
- Weather conditions

- Sample distribution and shipping

Information to be recorded during drilling activities shall include such items as:

- Names of field investigators and drilling personnel
- Start and completion times of each drilling event
- Measurements and quantities of materials used during drilling
- Depth and identification number of soil samples collected for chemical analysis
- Monitoring well completion data
- Water level measurements and grout levels (borehole sealing information)
- Record of site visitors

Information related to the construction of monitoring wells will be supplied to the driller for completion and submittal of NJDEP Form A - Monitoring Well Certification Form.

Soil boring logs will be kept for each borehole to provide a record of drilling and sampling methods, and to characterize subsurface materials (see example in Figure 5-1). The log will include such items as:

- Name of subcontractor
- Make and type of equipment
- Dates and times of drilling
- Dimensions and depth of borings and casing
- Penetration data for samples
- Data on rock coring, soil and fill material description and classification
- Dates, times of groundwater observations

The logs will show the depths at which subsurface material changes occur and will identify samples retained for laboratory analysis (physical or chemical). Rock cores will be described as to lithology, fracture frequency, degree of weathering of rock and fractures, fracture fit, fracture spacing, orientation of fractures, odors and stains present in rock core, percent recovery, and percent RQD.

A detailed description of visual identification and classification of subsurface materials is outlined in Section 2.4.

Monitoring well installation logs will be kept for each monitoring well to provide a detailed record of installation techniques, materials, and monitoring well configuration (screen depth, total depth, etc.). These monitoring well logs will be kept on typical monitoring well construction diagrams (varies by drilling firm). The monitoring well logs shall include such items as:

- Name of driller (firm and personnel)
- Make and type of equipment used
- Date of installation
- Borehole dimensions (diameter, total depth)
- Screened interval
- Materials used and quantities of each
- Intervals each material is installed in well (e.g., bentonite seal, sand pack, etc.)
- Water level information during and after construction

5.7.2 Photographic Record

Sample locations will be recorded in color photographs and the following types of information will be recorded in the photograph logbook:

- Name of site
- Date and time
- Photographed by (signature)
- General direction faced and description of subject taken

- Sequential number of the photograph and the roll number

ECKENFELDER, INC.

SOIL BORING LOG

Project: Site 113 - Diamond Site	Boring No:
Project Location: 1015 Belleville Turnpike, Kearny	113GT4

Start/Finish Date:	T.D. Borehole:	Ground Surface Elevation:	Monitoring Device:	Geologist/Office:
3/1/00 - 3/1/00	16.0 feet	ft. (MSL)	Hnu	J. Stott / Mahwah

Sampling Method:	Drilling Contractor/Driller:	Drilling Method:	Drilling Equipment:
3 in Split Spoon	Summit Drillling	Split Spoon	Drill Rig

Memo: Boring installed in Wetlands area.

Well Installed: No

Depth Below Surface (ft.)	Penetration Results: Blows 6"-6"-6"-6"	BPF	Sample Interval/Recovery	Field PID/FID (ppm)	Burmister System Soil Description Color, Texture, Moisture, Etc.	Unified Classification	Graphic Log	ORP (mV)	Eh (mV)	pE (mV)	pH
0	5-22-10-4				Reddish brown m SAND, some Gravel & Silt.						
2	1-1-3-4				Bright yellow/green CLAY, little Silt and f Sand, saturated.	CL ML					
4	1-1-0-3				Olive green CLAY, some Silt and f Sand, saturated.						
6	1-0-0-0				Olive green/yellow CLAY, some Silt, saturated.						
8	1-0-2-3				Olive green/yellow f SAND & SILT, saturated.						
10	3-3-3-6				Olive green/yellow f SAND & SILT, saturated.						
12	11-9-7-7				Dark brown to black f SAND & SILT, saturated	SP SM					
14	11-16-21-30					PT					

ECKENFELDER, INC.

SOIL BORING LOG

Project: **Site 113 - Diamond Site**
Project Location: **1015 Belleville Turnpike, Kearny**

Boring No: 113GT4

Depth Below Surface (ft.)	Penetration Results: Blows 6"-6"-6"-6"	Penetration Results: BPF	Sample Interval/Recovery	Field PID/FID (ppm)	Burmister System Soil Description Color, Texture, Moisture, Etc.	Unified Classification	Graphic Log	Field Measurements: ORP (mV)	Field Measurements: Eh (mV)	Field Measurements: pE (mV)	Field Measurements: pH
					Meadow mat material.						
16											

6.0 MANAGEMENT OF DRILL CUTTINGS AND DECONTAMINATION LIQUID

6.1 DRILL CUTTINGS

In areas where historical information, field instruments, and/or visual observations show presence of contamination, drilling mud, drill cuttings, soil samples, excess soil material, and development water will be drummed (steel or polypropylene, as appropriate) and stored on-site in steel, water tight and lockable, cargo shipping containers in accordance with the EDP.

Should test pits be utilized for investigation, and as long as those test pits are terminated above the water table, material excavated will be returned to the hole. If containers are encountered, they will be excavated and examined. If appropriate, they will be secured in overpacks and stored in the above-mentioned shipping container(s). Holes produced from soil borings reaching ground water will be grouted unless the project team determines the material can be returned to the hole. Holes not grouted will be filled with sufficient quantities of material to make up for amount of soil sampled and settling to return the hole to natural grade.

The stored materials will be properly classified and disposed of off-site, subsequent to the completion of RI activities, in accordance with applicable regulations.

Uncontaminated materials will be disposed on-site provided the following are met:

A Disposed cuttings/soil will not spill off-site.

B NJDEP concurs with the disposal procedure(s).

6.2 DECONTAMINATION WATER/WELL DEVELOPMENT WATER

Decontamination water/well development water will be managed in accordance with the procedures outlined above in Section 6.1.

6.3 OTHER POTENTIALLY CONTAMINATED MATERIAL

Potentially contaminated materials (such as personnel protective equipment) will be managed in accordance with the procedures outlined in Section 6.1.

7.0 ENVIRONMENTAL SAMPLE CUSTODY AND SHIPPING PROCEDURES

7.1 SAMPLE CUSTODY AND RESPONSIBILITIES

Chain-of-Custody procedures as outlined in the NJDEP Field Sampling Procedures Manual (May 1992) will be utilized. Specific procedures to be used are described below.

7.1.1 Custody Definitions

- Chain-of-Custody Officer - The Chain-of-Custody Officer will be responsible for oversight of chain-of-custody activities. The lead geologist or lead sampler will usually implement these activities.

- Under Custody - A sample is "Under Custody" if:

  1 It is in the possession of the Chain-of-Custody Officer, or
  2 It is in the view of the Chain-of-Custody Officer, after being in his possession, or
  3 It was in his possession and is now secured, or
  4 It is in a designated secure area.

7.1.2 Responsibilities

The Chain-of-Custody Officer is responsible for monitoring all chain-of-custody activities and for collecting legally admissible copies of chain-of-custody documentation for the permanent project file. He shall be responsible for:

1 An initial review of sample labels and/or tags, closure tapes, and chain-of-custody record and split-sample forms provided by the laboratory. The Chain-of-Custody Officer will document this review in the field logbook.

2 Training of all field sampling personnel in the methodologies for carrying out chain-of-custody procedures and the proper use of all chain-of-custody forms and record documents.

3 Monitoring implementation of chain-of-custody procedures.

7.1.3 Chain-of-Custody

Cleaned or unused sample containers will be delivered to the Brown and Caldwell office in Mahwah, New Jersey by either laboratory courier or overnight delivery service. Each chain-of-custody form (including all extra sets of forms for additional containers) will be signed and dated by the laboratory when releasing custody of the containers. The Brown and Caldwell field personnel will sign and date the chains, noting the time they open the coolers following receipt. When the sample containers are received they will be checked for any breach of chain-of-custody seals or evidence of tampering.

The sample containers will be carried into the field by field sampling personnel, where they will be used to collect samples. When the samples are collected, container labels shall be filled out by the geologist/field sampling personnel. Each label will include such information as the following:

- Site name
- Sample identification (see Section 7.2.1)
- Project number
- Date/time
- Samplers' initials
- Sample preservation (if any) designation
- Analysis required

At the time of sampling, the field sampling personnel will record sample information on a chain-of-custody form (sample shown in Figure 7-1). Chain-of-custody form entries will be made in indelible ink.

After sampling containers are filled, the field sampling personnel will place the filled containers in coolers and maintain custody of all samples until they are transferred to the command office for processing. After samples are processed at the command office, they will be prepared for shipping.

7.1.4 Split-Sample Records

Whenever samples are split (e.g., with NJDEP), a split-sample receipt will be prepared. The receipt will describe the samples being split, including the quantity (mass or volume) of each sample portion. Both the laboratory and/or field sampling personnel, should samples be split in the field, will retain copies of the split-sample receipt. The chain-of-custody forms (Figure 7-1) will be used to document split-sample receipts and will accompany both portions of the sample.

7.2 SAMPLE LABELING AND SHIPPING

Each label will include such information as the following:

- Site name
- Sample identification (see Section 7.2.1)
- Project number
- Date/time
- Samplers' initials
- Sample preservation (if any) designation
- Analysis required

7.2.1 Sample Identification Codes

Each sample will be assigned a unique alpha-numeric identification code. An example of this code and a description of its components is presented below:

Examples

1 116-W-002-GW

116 = Chromite Site #116
W-002 = Monitoring Well # 2
GW = Groundwater

2 116-B-001-0-2

116 = Chromite Site #116
B = Soil Boring
001 = Sample number
0-2 = Soil Boring Sample from 0'-2' depth

List of Abbreviations

Sample Location Identifications

W = Ground water monitoring well
B = Soil Boring
S = Surface water
SE = Sediment

Other Label Information

TB = Trip blank

FB = Field Blank

F = Filtered water sample

T = Unfiltered water sample

7.2.2 Shipping of Environmental Samples

The samples collected will be categorized as environmental samples. The environmental samples will consist of potentially contaminated surface water, groundwater, sediments, and soils. It is anticipated that the environmental samples that will be collected are likely to have moderate concentrations of contaminants and shall be handled as such for shipping purposes. COPR samples and highly contaminated soil or groundwater (contaminated with high levels of organics) will be shipped as environmental samples using the procedures discussed below. Sediment and surface water samples shall normally be classified as environmental samples.

Environmental samples shall be shipped using the following steps:

1 Fill out the chain-of-custody record with relevant information.

2 Place white original in a ziplock bag and tape it to the inside of the cooler if being sent by overnight delivery service to the laboratory. If a laboratory courier is being used, the COC should be taped to the top of the cooler.

3 Groundwater sample containers should be placed in ziplock bags and placed in the cooler.

4 All fragile (e.g., glass) containers with soil and/or aqueous samples will be placed in the cooler in such a way that they do not touch (use cardboard dividers).

5 A temperature blank container will be placed on top of the samples.

6 Ice will be double bagged and placed on top of the samples to maintain 4°C or less until the analytical laboratory receives them.

7 Duct tape (or appropriate substitute) will be wrapped around the complete circumference at two locations to secure the lid. Two custody seals will be signed and dated and placed over the sealed areas.

8 The laboratory address label will be affixed on the top of the cooler. If the cooler is being sent by overnight delivery service, the appropriate paperwork will be attached to the cooler and the tracking number noted in the field log book.

Analysis Request/Environmental Services Chain of Custody

Lancaster Laboratories
A division of Thermo Analytical Inc.

For Lancaster Laboratories use only
Acct. # ________ **Sample #** ________

Please print. Instructions on reverse side correspond with circled numbers.

1
Client: ________ Acct. #: ________
Project Name/#: ________ PWSID #: ________
Project Manager: ________ P.O.# ________
Sampler: ________ Quote #: ________
Name of state where samples were collected: ________

For lab use only
FSC: ________
SCR #: 1126239

2 Sample Identification	Date Collected	Time Collected	3 Grab	Composite	4 Matrix: Soil	Water ☐ Potable ☐ NPDES (Check if applicable)	Other	Total # of Containers	5 Analyses Requested								Remarks	6 Temperature of samples upon receipt (if requested)

7 **Turnaround Time Requested** (TAT) (please circle): Normal Rush
(Rush TAT is subject to Lancaster Laboratories approval and surcharge.)
Date results are needed: ________
Rush results requested by (please circle): Phone Fax
Phone #: ________ Fax #: ________

8 **Data Package Options** (please circle if requested)
QC Summary Type VI (Raw Data)
Type I (Tier I) GLP
Type II (Tier II) Other
Type III (NJ Red. Del.)
Type IV (CLP)

SDG Complete? Yes No

Site-specific QC required? Yes No
(If yes, indicate QC sample and submit triplicate volume.)

Internal Chain of Custody required? Yes No

Relinquished by:	Date	Time	Received by:	Date	Time
Kopp	5-17-99	1040			
Relinquished by:	Date	Time	Received by:	Date	Time
Relinquished by:	Date	Time	Received by:	Date	Time
Relinquished by:	Date	Time	Received by:	Date	Time
Relinquished by:	Date	Time	Received by:	Date	Time

9

8.0 FIELD QUALITY CONTROL/QUALITY ASSURANCE

8.1 CALIBRATION OF FIELD EQUIPMENT

Field equipment will be calibrated according to the manufacturer's recommended methods, as applicable. The following equipment will be calibrated daily:

- Photoionization detector
- Oxygen meter
- Explosimeter or combustible gas indicator
- Hydrogen sulfide (H_2S) meter

Other field equipment will be calibrated prior to use and/or at such intervals as recommended by the manufacturer.

8.2 PREVENTIVE MAINTENANCE OF FIELD EQUIPMENT

Field equipment will be maintained and serviced according to the manufacturer's recommendations. Equipment will be cleaned on a regular basis and/or decontaminated according to manufacturer's recommendations and the EDP.

PB2005106282

PUBLIC HEALTH ASSESSMENT FOR STANDARD CHLORINE CHEMICAL COMPANY, INCORPORATED, KEARNY, HUDSON COUNTY, NEW JERSEY, APRIL 5, 2005. EPA FACILITY ID: NJD002175057

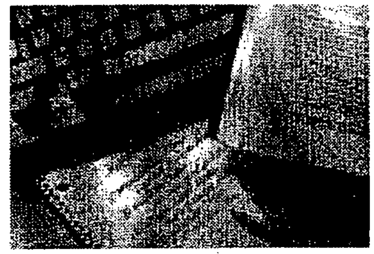
AGENCY FOR TOXIC SUBSTANCES AND DISEASE
REGISTRY
ATLANTA, GA

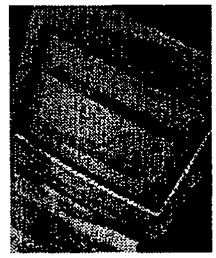
05 APR 2005

U.S. Department of Commerce
National Technical Information Service

One Source. One Search. One Solution.

NTIS





Providing Permanent, Easy Access to U.S. Government Information

National Technical Information Service is the nation's largest repository and disseminator of government-initiated scientific, technical, engineering, and related business information. The NTIS collection includes almost 3,000,000 information products in a variety of formats: electronic download, online access, CD-ROM, magnetic tape, diskette, multimedia, microfiche and paper.

Search the NTIS Database from 1990 forward

NTIS has upgraded its bibliographic database system and has made all entries since 1990 searchable on **www.ntis.gov.** You now have access to information on more than 600,000 government research information products from this web site.

Link to [illegible] Text Documents at Government Web Sites

Because many Government agencies have their most recent reports available on their own web site, we have added links directly to these reports. When available, you will see a link on the right side of the bibliographic screen.

Download Publications (1997 - Present)

NTIS can now provides the full text of reports as downloadable PDF files. This means that when an agency stops maintaining a report on the web, NTIS will offer a downloadable version. There is a nominal fee for each download for most publications.

For more information visit our website:

www.ntis.gov

U.S. DEPARTMENT OF COMMERCE
Technology Administration
National Technical Information Service
Springfield, VA 22161

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

STANDARD CHLORINE CHEMICAL COMPANY, INCORPORATED
KEARNY, HUDSON COUNTY, NEW JERSEY
EPA FACILITY ID: NJD002175057
APRIL 5, 2005

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
Agency for Toxic Substances and Disease Registry

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment was prepared by ATSDR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) section 104 (i)(6) (42 U.S.C. 9604 (i)(6)), and in accordance with our implementing regulations (42 C.F.R. Part 90). In preparing this document, ATSDR has collected relevant health data, environmental data, and community health concerns from the Environmental Protection Agency (EPA), state and local health and environmental agencies, the community, and potentially responsible parties, where appropriate.

In addition, this document has previously been provided to EPA and the affected states in an initial release, as required by CERCLA section 104 (i)(6)(H) for their information and review. The revised document was released for a 30-day public comment period. Subsequent to the public comment period, ATSDR addressed all public comments and revised or appended the document as appropriate. The public health assessment has now been reissued. This concludes the public health assessment process for this site, unless additional information is obtained by ATSDR which, in the agency's opinion, indicates a need to revise or append the conclusions previously issued.

Agency for Toxic Substances & Disease Registry .... Julie L. Gerberding, M.D., M.P.H., Administrator
Thomas Sinks, Ph.D., M.S., Acting Director

Division of Health Assessment and Consultation .... William Cibulas, Jr., Ph.D., Director
Sharon Williams-Fleetwood, Ph.D., Deputy Director

Community Involvement Branch .... Germano E. Pereira, M.P.A., Chief

Exposure Investigations and Consultation Branch .... Donald Joe, M.S., Deputy Branch Chief

Federal Facilities Assessment Branch .... Sandra G. Isaacs, B.S., Chief

Superfund and Program Assessment Branch .... Richard E. Gillig, M.C.P., Chief

Use of trade names is for identification only and does not constitute endorsement by the Public Health Service or the U.S. Department of Health and Human Services.

Additional copies of this report are available from:
National Technical Information Service, Springfield, Virginia
(703) 605-6000

You May Contact ATSDR TOLL FREE at
1-888-42ATSDR
or
Visit our Home Page at: http://www.atsdr.cdc.gov

PUBLIC HEALTH ASSESSMENT

STANDARD CHLORINE CHEMICAL COMPANY, INCORPORATED

KEARNY, HUDSON COUNTY, NEW JERSEY

EPA FACILITY ID: NJD002175057

Prepared by:

New Jersey Department of Health and Senior Services
Consumer and Environmental Health Services
Under a Cooperative Agreement with the
U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

FOREWORD

The Agency for Toxic Substances and Disease Registry, ATSDR, was established by Congress in 1980 under the Comprehensive Environmental Response, Compensation, and Liability Act, also known as the *Superfund law*. This law set up a fund to identify and clean up our country's hazardous waste sites. The Environmental Protection Agency, EPA, and the individual states regulate the investigation and clean up of the sites.

Since 1986, ATSDR has been required by law to conduct a public health assessment at each of the sites on the EPA National Priorities List. The aim of these evaluations is to find out if people are being exposed to hazardous substances and, if so, whether that exposure is harmful and should be stopped or reduced. (The legal definition of a health assessment is included on the inside front cover.) If appropriate, ATSDR also conducts public health assessments when petitioned by concerned individuals. Public health assessments are carried out by environmental and health scientists from ATSDR and from the states with which ATSDR has cooperative agreements. The public health assessment program allows the scientists flexibility in the format or structure of their response to the public health issues at hazardous waste sites. For example, a public health assessment could be one document or it could be a compilation of several health consultations - the structure may vary from site to site. Nevertheless, the public health assessment process is not considered complete until the public health issues at the site are addressed.

Exposure: As the first step in the evaluation, ATSDR scientists review environmental data to see how much contamination is at a site, where it is, and how people might come into contact with it. Generally, ATSDR does not collect its own environmental sampling data but reviews information provided by EPA, other government agencies, businesses, and the public. When there is not enough environmental information available, the report will indicate what further sampling data is needed.

Health Effects: If the review of the environmental data shows that people have or could come into contact with hazardous substances, ATSDR scientists evaluate whether or not these contacts may result in harmful effects. ATSDR recognizes that children, because of their play activities and their growing bodies, may be more vulnerable to these effects. As a policy, unless data are available to suggest otherwise, ATSDR considers children to be more sensitive and vulnerable to hazardous substances. Thus, the health impact to the children is considered first when evaluating the health threat to a community. The health impacts to other high risk groups within the community (such as the elderly, chronically ill, and people engaging in high risk practices) also receive special attention during the evaluation.

ATSDR uses existing scientific information, which can include the results of medical, toxicologic and epidemiologic studies and the data collected in disease registries, to determine the health effects that may result from exposures. The science of environmental health is still developing, and sometimes scientific information on the health effects of certain substances is not available. When this is so, the report will suggest what further public health actions are needed.

Conclusions: The report presents conclusions about the public health threat, if any, posed by a site. When health threats have been determined for high risk groups (such as children, elderly, chronically ill, and people engaging in high risk practices), they will be summarized in the conclusion section of the report. Ways to stop or reduce exposure will then be recommended in the public health action plan.

ATSDR is primarily an advisory agency, so usually these reports identify what actions are appropriate to be undertaken by EPA, other responsible parties, or the research or education divisions of ATSDR. However, if there is an urgent health threat, ATSDR can issue a public health advisory warning people of the danger. ATSDR can also authorize health education or pilot studies of health effects, full-scale epidemiology studies, disease registries, surveillance studies or research on specific hazardous substances.

Interactive Process: The health assessment is an interactive process. ATSDR solicits and evaluates information from numerous city, state and federal agencies, the companies responsible for cleaning up the site, and the community. It then shares its conclusions with them. Agencies are asked to respond to an early version of the report to make sure that the data they have provided is accurate and current. When informed of ATSDR's conclusions and recommendations, sometimes the agencies will begin to act on them before the final release of the report.

Community: ATSDR also needs to learn what people in the area know about the site and what concerns they may have about its impact on their health. Consequently, throughout the evaluation process, ATSDR actively gathers information and comments from the people who live or work near a site, including residents of the area, civic leaders, health professionals and community groups. To ensure that the report responds to the community's health concerns, an early version is also distributed to the public for their comments. All the comments received from the public are responded to in the final version of the report.

Comments: If, after reading this report, you have questions or comments, we encourage you to send them to us.

Letters should be addressed as follows:

Attention: Division of Health Assessment and Consultation, Agency for Toxic Substances and Disease Registry, 1600 Clifton Road (E-60), Atlanta, GA 30333.

Table of Contents

SUMMARY

The Standard Chlorine Chemical Company site is located at 1015 through 1035 Belleville Turnpike, Kearny, Hudson County, New Jersey. The site covers approximately 25 acres and is in an industrial area of Hudson County. Manufacturing operations were conducted at the site by various companies between 1916 and 1993 and included the refining of naphthalene, the manufacture of products from naphthalene, naphthalene derivatives and dichlorobenzenes, the formulation of drain cleaning products, and on a limited basis, the processing of trichlorobenzene during the 1970s. All operations ceased at the site in 1993.

The primary contaminants of concern at the Standard Chlorine site include polychlorinated biphenyls, chlorinated benzene compounds, naphthalene, chromium and 2,3,7,8-tetrachlorodibenzo-p-dioxin. On-site soil, sediment, surface water and groundwater contaminants migrate into the adjacent Hackensack River primarily by direct surface runoff and drainage ditches that run along the northern and southern property boundaries. Additionally, drums containing various site-related hazardous substances, including dioxin-contaminated asbestos, are consolidated into six sea boxes at the site. Based on October 2002 United States Environmental Protection Agency sampling results as well as results from previous sampling events that documented extensive on-site soil and groundwater contamination, the site was proposed to be added to the National Priorities List on April 30, 2003.

Although there are no completed human exposure pathways associated with the Standard Chlorine Company site at this time, the on-site contamination of soil, surface water, ground water and sediment is present at levels well above environmental comparison values. Migration of these contaminants into the Hackensack River has been documented by direct observation (e.g., a seep) and stated in the Administrative Consent Order issued by the New Jersey Department of Environmental Protection. There are two popular fishing locations on the banks of the river both 0.5 miles upstream and downstream from Standard Chlorine and hook and line fishing from boats takes place on the Hackensack River off the Standard Chlorine property. Despite the recommendations of the Fish Consumption Advisory, fishing and crabbing for consumption continues to occur. The Hackensack River is utilized by families for seasonal recreational activities such as kayaking, canoeing and the use of personal water crafts (i.e., jet skiing). The recreational uses of the Hackensack River are intermittent and therefore frequent significant exposures via ingestion of sediment/surface water pathway are unlikely. The site is potentially accessible to trespassers from the shore-bound side; however, the potential for exposure to these individuals on a routine basis is unlikely.

The New Jersey Department of Health and Senior Services, in cooperation with the Agency for Toxic Substances and Disease Registry, has concluded that the Standard Chlorine Chemical company site currently represents an ***"Indeterminate Public Health Hazard"*** for the biota (consumption of marine life) and ambient air pathways. Data associated with the biota pathway is not currently available and this pathway is the most significant pathway of exposure associated with the site, partly due to the possibility of repeated exposures. Due to lack of air monitoring data for the contaminants of concern, it is difficult to determine the potential health impact of airborne contaminants to on- and off-site worker populations, residential communities living beyond the one-mile radius of the site, site visitors and trespassers.

Frequent, significant exposures to the contaminants of concern via trespassing and recreational uses of the river pathways is unlikely. Therefore, the Public Health Hazard Category recommended for these pathways is ***"No Apparent Public Health Hazard"***.

The Kearny Department of Health, the New Jersey Department of Environmental Protection, and the United States Environmental Protection Agency have reported no community concerns regarding the site. Based on currently available data, there were no identified completed exposure pathways associated with the site and no health outcome data for the Standard Chlorine site was evaluated at this time. In the past, the New Jersey Department of Health and Senior Services designed and conducted a screening project, named the Chromium Medical Surveillance Project, to determine potential exposures to people living and/or working near chromium waste sites in Hudson and Essex counties. The Standard Chlorine site was included as part of 78 workplaces targeted for screening services. Screening results indicated little evidence of clinically observable chromium-induced health effects. However, there was evidence of low levels of exposure to chromium among some participants living and/or working in the vicinity of chromium waste sites, including adult workers at the Standard Chlorine site (New Jersey Department of Health 1994).

Without extensive remedial action, the contaminants currently present on-site would represent a potential public health concern if conditions or land use at the site change, resulting in potential future exposures. It is recommended that groundwater (on- and off-site) delineation be conducted to assess the transport of on-site contaminants into the Hackensack River. It is also recommended that air monitoring be conducted by the New Jersey Department of Environmental Protection to identify the potential impact of airborne contaminants to residential communities living beyond the one-mile radius of the site. Further, it is recommended that air monitoring be implemented during remedial activities to determine the potential health impact of airborne contaminants to on- and off-site worker populations.

Hackensack River fish tissue studies are currently underway by the New Jersey Department of Environmental Protection. When available, the results will be reviewed to evaluate the contribution of site-related contamination to the biota pathway.

PURPOSE AND HEALTH ISSUES

On April 30, 2003, the United States Environmental Protection Agency proposed to add the Standard Chlorine Chemical Company (Standard Chlorine) site, Kearny, Hudson County, New Jersey, to the National Priorities List (NPL) of Superfund sites. The New Jersey Department of Health and Senior Services (NJDHSS), in cooperation with the Agency for Toxic Substances and Disease Registry (ATSDR), prepared the following public health assessment to review environmental data obtained from the site, define potential human exposure to contaminants, and to determine whether the exposures are of public health concern.

BACKGROUND

A. Site History

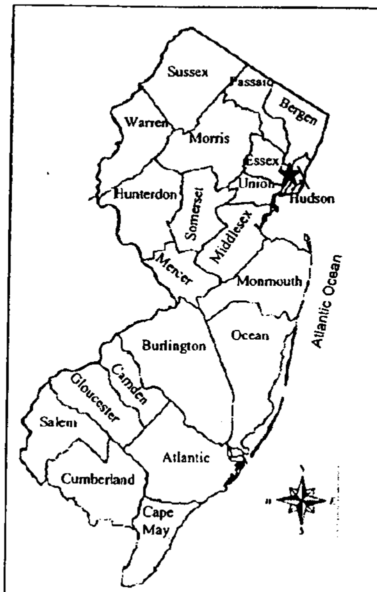


Figure 1: Location of the Standard Chlorine Chemical Company site

The Standard Chlorine site is approximately 25 acres in size and is located at 1015 through 1035 Belleville Turnpike, Kearny, Hudson County. The site location is shown in Figure 1. The site is bounded by the Hackensack River to the east, Belleville Turnpike to the west, and to the north by the former Diamond Shamrock site, which is currently owned by Tierra Solutions, Inc. (formerly Chemical Land Holdings, Inc.). The former Koppers Company, Inc. (Koppers) Seaboard site, currently owned by Beazer East, Inc. borders the Standard Chlorine site to the south. The site layout is shown in Appendix A, Figure 2. The Diamond Shamrock site was a chromate chemical manufacturing facility and past operations at the Koppers Seaboard site included coke production, and coal-tar refining. Operations on these properties adjacent to the Standard Chlorine site were discontinued during the 1970s.

Early site history indicates that the White Tar Company refined crude naphthalene (a.k.a. white tar, moth balls, tar camphor) at the site from 1916 until 1942 when the Koppers Company acquired the site and continued similar manufacturing activities, producing naphthalene products and creosote disinfectants. Koppers also stored and packaged 1,4-dichlorobenzene moth preservatives and deodorizers in solid form at the site.

Standard Chlorine operated at the site from 1963 to 1993. Operations at the site included the manufacture of moth crystals and flakes from dichlorobenzene. Standard Chlorine also separated and stored 1,2,4-trichlorobenzene at the site from 1970 until 1980. Standard Naphthalene Products, a wholly owned subsidiary of Standard Chlorine, processed liquid petroleum naphthalene at the site from 1963 until 1982. In addition, from 1963 until 1987, Chloroben Chemical Corporation, another wholly owned subsidiary of Standard Chlorine operated a batch formulation and blending operation producing various solvents and inorganic chemicals for use in cleaning drains, sewers, and septic tanks. Some Chloroben products were formulated at the site from 1,2-dichlorobenzene. The naphthalene refining operations were conducted in the eastern two-thirds of the site. The manufacture of dichlorobenzene products and the formulations of drain cleaning products occurred in the western one-third of the site. Trichlorobenzene processing occurred in the northeastern section of the property. All operations at the site ceased in 1993. Currently, the site has no manufacturing operations and limited administrative activities are conducted in an office building located on the western end of the site.

Chromium ore processing residue (COPR) generated by three chromite ore smelting facilities located in Hudson County, was deposited in over 160 sites in Hudson and Essex Counties. The chromate waste was used as fill in preparation for building foundations, construction of tank berms, roadway construction, filling of wetlands, sewerline construction and other construction and development projects (New Jersey Department of Health 1994). Two to 10 feet of COPR underlie approximately 85 percent of the Standard Chlorine site.

The site generally consists of two distinct areas. The western two-thirds of the site contain the previous plant manufacturing activities; and the eastern third contains a lagoon system in the former processing area (see Appendix A, Figure 2). Residual waste materials are currently present within the lagoon system, which has two segments designated as the east lagoon and west lagoon. The lagoon system occupies a surface area of approximately 33,000 square feet and has an average depth of six feet. The lagoon system received process wastewaters generated from various processes at the site. Historically, the lagoon effluent has overflowed by gravity into the adjacent Hackensack River (Brown and Caldwell 2001). In 1991, measures were taken to stabilize the embankment adjacent to the river and build up the berm around the lagoon system (Weston 1993).

Aerial photographs indicate that there have been discharges to the Hackensack River from this site (Brown and Caldwell, 2001; USEPA 2003). These photographs indicate piping had existed which allowed discharge into the lagoon system. The piping appears to originate from the buildings areas directly north of the lagoon system (USEPA 2003). The lagoon system is unlined and the base of the waste material is in contact with the water table. These photographs also indicate that the above-ground product storage tanks had no secondary containment and dark toned stained soil was documented in the western end of the property as well as the processing buildings north of the lagoon system.

A NJDEP inspection of the site on August 1982 reported spills of naphthalene and dichlorobenzenes on the ground surface at the site in several areas (USEPA 2003). In 1985, NJDEP collected and analyzed soil and sediment samples from 32 sites where compounds known to be associated with dioxin were produced as part of the Dioxin Site Investigation Program (NJDEP 1985). Standard Chlorine was included due to the usage of 1,2,4-trichlorobenzene and 1,2-dichlorobenzene at the site. This study revealed extensive 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) contamination in the lagoon system and in the former processing area north of the lagoon system, as evidenced by soil sampling and wipe samples of buildings, respectively (scc Appendix A, Figure 2).

In October 1989, an Administrative Consent Order (ACO) was executed between Standard Chlorine and the NJDEP to conduct the necessary remedial investigations and perform remedial action(s). At NJDEP's direction in June 2000, Standard Chlorine performed an inventory of containerized waste materials stored in a building near the lagoon area. The inventory revealed the presence of dioxin-contaminated asbestos in approximately 400 drums and seven plastic bags. These and other drums containing waste materials from previous site investigations were consolidated into six sea boxes and remain on site. In December 2001, NJDEP terminated their ACO, indicating that Standard Chlorine had not completed remedial investigation activities and was non-compliant with the terms of the ACO. They requested that the USEPA evaluate the Standard Chlorine site as a candidate for listing on the NPL, based on complex environmental issues present at the site and the inability of the various responsible parties to implement effective remedial actions at the site. Based on results from sampling conducted by the USEPA in October 2002, as well as results from previous sampling events that documented extensive soil and groundwater contamination throughout the site, the USEPA determined that the site ranked for NPL listing. The USEPA proposed to add the Standard Chlorine site to the NPL on April 30, 2003.

The Standard Chlorine site lies in the Hackensack Meadowlands which has been identified by the United States Fish and Wildlife Service as a Significant Habitat Complex of the New York Bight Watershed at the request of the USEPA's New York/New Jersey Harbor Estuary Program, and may be a habitat for designated endangered and/or threatened species (USEPA 2003). There are also at least seven species of fish in the river that have management plans through the National Marine Fisheries Service thereby making the river Essential Fish Habitat. Additionally, of the 265 species of birds that migrate through the Meadowlands, 63 species nest in the Meadowlands and some use the river as a food source (USEPA 2003).

B. Site Characterization

Surface Drainage

The general direction of flow of on-site surface water is east, towards the Hackensack River. This run-off enters the Hackensack River via two outfall pipes (see Appendix A, Figure 2). Along the northern site boundary, a 48-inch diameter underground concrete stormwater pipe equipped with a tide gate receives run-off from the former Diamond Shamrock property and other commercial and industrial properties located to the west.

The eastern and western portions of the site generally slope to a central drainage swale, which receives flow from drainage ways near Buildings 2, 3 and 4 in the southwestern portion of the site (see Appendix A, Figure 2). This swale directs surface water to a drainage ditch that runs along the southern site boundary. A small drainage way along the eastern side of an abandoned railroad spur in the center of the site also drains southward into this ditch. Additionally, shallow groundwater also discharges to this southern drainage ditch. The on-site surface water in the ditch enters the Hackensack River via the south outfall, also equipped with a tide gate. A wetlands area lies south of this drainage ditch, in the former Koppers property.

The Hackensack River borders the entire eastern property boundary. It is tidally influenced and flows south to the Newark Bay. The overall direction of flow in the Hackensack River is from north to south.

Site Geology and Hydrogeology

Fill materials were placed in the coastal marshlands of the region to create property for industrial development. These fill materials generally consisted of COPR and silty sand, to depths ranging between 2 to10 feet below present grade. Underneath this fill material lies the original marsh surface, known as the Meadow Mat, consisting of silt, humus and peat. It is typically two to five feet thick. A sand layer is present beneath the Meadow Mat that is generally less than ten feet thick. A silt and clay unit is present beneath the sand layer and this layer is continuous beneath the Standard Chlorine site (Key Environmental 1997). Site characterization activities have focused on two separate groundwater-bearing units: 1) the shallow fill unit; and 2) the sand unit that underlies the Meadow Mat. The water table at the site occurs in the fill material placed above the Meadow Mat.

The groundwater flow in the fill material is primarily to the south, approximately parallel to the direction of flow in the Hackensack River. Groundwater in the fill unit in the eastern portion of the Standard Chlorine site discharges to the Hackensack River and the southern drainage ditch. Studies have indicated that the groundwater within the fill material is not tidally influenced. Groundwater in the sand unit beneath the Meadow Mat flows primarily to the south-southeast towards the drainage ditch. The underlying clay acts as an effective barrier to the downward migration of groundwater from this unit. Groundwater within the sand unit is tidally influenced to a limited extent.

C. Demography and Land Use

The Standard Chlorine site is located in an industrial area near the New Jersey Turnpike and Belleville Turnpike. Based upon the 2000 United States Census, population demographics indicate that there are no people or housing units within a one-mile radius of the site (see Appendix A, Figure 3). The site is within the New Jersey Meadowlands Commission Hackensack Meadowlands District, which has zoned the site as intermodal (see Appendix A, Figure 4). Permitted uses within this zoning are motor freight terminals, freight forwarding and intermodal facilities. The nearest residential area in Kearny is over two miles to the west.

D. Past ATSDR/NJDHSS Involvement

From January 1992 through September 1993, the New Jersey Department of Health designed and conducted a screening project to determine potential exposure to people living and/or working near chromium waste sites in Hudson and Essex counties. This project, named the Chromium Medical Surveillance Project, included the workers at the Standard Chlorine site as part of 78 workplaces targeted for screening services. The project found evidence of exposure to adult workers at the Standard Chlorine site (New Jersey Department of Health 1994).

E. Site Visits

February 18, 2004 Site Visit

On February 18, 2004 staff performed a site visit of the Standard Chlorine site. Present were Steven Miller, Julie Petix, Tariq Ahmed, Somia Aluwalia of the NJDHSS, Leah Escobar of the ATSDR, and representatives of the NJDEP, Tierra Solutions, Inc., (current owner of the former Diamond Shamrock site); Standard Chlorine, Inc., Langan Engineering and Environmental Services, Beazer East Inc. (current owner of the former Koppers Company, Inc.), and of Key Environmental Inc.

The site visit commenced at 9:30 am. The weather conditions were sunny, cold with temperature in the mid 30s with a stiff breeze. As seen in Figure 2, the site is bordered to the north by the former Diamond Shamrock site; to the east by the Hackensack River; to the south by the former Koppers site; and to the west by the Belleville Turnpike. The main driveway leading to Standard Chlorine from the Belleville Turnpike is gated and this driveway runs along the entire northern boundary of the Standard Chlorine site. This driveway is common to Standard Chlorine and the former Diamond Shamrock sites. Tierra Solutions, Inc. leases their property for trailer storage and therefore the driveway is accessed by drivers transferring trailers in the former Diamond Shamrock site. The Standard Chlorine site is fenced and gated along the western perimeter and there is an old wooden guard house that was unoccupied at the time of the site visit. "No trespass" signs were observed at northeastern part of the fence that separates the lagoon system in the Standard Chlorine site from the main driveway. All buildings on the site are abandoned with the exception of an office building located on the western end of the site. Individuals present for the site visit convened in this office building to discuss major issues associated with the contaminants of concern at the site.

The site visit proceeded from this office building to an area where six sea boxes are stored, containing dioxin-contaminated asbestos and mixed organic wastes. Numerous physical hazards were present at the site including dilapidated buildings, broken windows, debris, and an open drainage ditch. Additionally, areas along the edge of the Hackensack River were littered with rubbish and debris. The site is mostly covered with asphalt, and in some sections, gravel. The asphalt and gravel caps were placed as part of interim remedial measures by the former Diamond Shamrock Company to address exposures associated with the COPR. A series of locked gates were encountered within the Standard Chlorine site. The lagoon system, located on the eastern part of the site, was visible from the Conrail right-of-way access road (Appendix A, see Figure 2). The area surrounding the lagoon system is enclosed by a six-foot high barbed wire fence. This fence is referred to as a "dust fence barrier" since it is lined with black tarp to reduce export of particles from the lagoon system area. A trench with standing water was observed inside the fenced area. The smell of naphthalene/moth balls was noted here. The southern boundary of the Standard Chlorine site was encountered which is comprised of an open drainage ditch that ultimately empties into the Hackensack River. This southern outfall into the Hackensack River was not visible from the fenced area near the lagoons. The drainage ditch had mixed standing and frozen water. *Phragmites australis* (or common reed), a wetland plant species, was observed on either side of the ditch. The former Koppers site was on the southern side of the drainage ditch and was observed to be marshy.

The Hackensack River was at low tide during the site visit. The site visit personnel proceeded to the driveway between Tierra Solutions, Inc. and Standard Chlorine and observed the north outfall into the Hackensack River from the buried storm sewer that runs along the entire northern boundary of the Standard Chlorine site. Brown green puddles, possibly indicative of chromium contaminated water, were observed on the surface of the driveway. Upwelling of the water into the driveway occurs due to the high water table, especially under wet weather conditions. Surface water, rapidly running into a sewer drain was also observed on this driveway.

A small number of Standard Chlorine personnel occasionally work in the on-site office building. When asked about vandalism, they commented that it was a problem in the past, occurring primarily at night. This was evident from the numerous broken windows observed for on-site buildings, although Standard Chlorine personnel stated that wind damage accounted for some of this damage. According to Standard Chlorine personnel, individuals from various trucking companies periodically visit the site to inquire about the sale of the property. Local discussions about possible future uses for the site included light industrial warehousing (e.g., big box storage) and commercial (e.g., Walmart, Lowe's). Recreational uses of the Hackensack River adjacent to the site were not discussed during the site visit; this was discussed separately in a telephone conversation with the Hackensack Riverkeeper.

There was a paucity of typical signs of trespassing such as graffiti, cigarette butts and beverage cans. It was observed that not all fences were topped with barbed wire; therefore access by a determined trespasser would be plausible. During the site visit, a truck driver parking a trailer on the former Diamond Shamrock site related an incident of an individual who had used the shoreline on that property for launching his boat and was accidentally locked in when the truck driver locked the gates following his departure. Overall, the site seemed secure from the land-bound side; any potential trespassing would be limited to older children or adults. The river-bound portion of the site is not fenced and therefore access from the Hackensack River is possible. Although trash was observed along the shore-line, it was difficult to determine if this was due to trespassers or if it was wash-up from the tidally influenced Hackensack River. Pictures from this site visit are catalogued in Appendix B.

April 30, 2004 Site Visit

On April 30, 2004, staff performed a second site visit of the Standard Chlorine site in the form of an Eco-Cruise boat tour of the Hackensack River. Present were Somia Aluwalia, Christa Fontecchio, Sharon Kubiak and Steven Miller of the NJDHSS, Leah Escobar, Arthur Block of the ATSDR, representatives of the NJDEP and the NY/NJ Baykeeper, and the Hackensack Riverkeeper. The Eco-Cruise tour lasted two and half hours.

The site visit commenced at 12:10 pm at the marina located on the Hackensack River behind the Red Roof Inn, Secaucus, Hudson County. It was partly cloudy with temperatures in the 70s. The direction of the Eco-Cruise boat tour was from north to south, towards the Newark Bay. The riverkeeper began his tour by describing the layout of the Hackensack River on an illustrated map and highlighted the towns of Secaucus, Rutherford, Lyndhurst and Kearny. Wildlife refuge areas such as Saw Mill Creek, Riverbend Wetland Preserve and Lyndhurst Marshes were also pointed out on the map. The riverkeeper mentioned that although the former Honeywell (chromium manufacturing) property was located downstream from the Standard Chlorine site, chromium was detected in the Hackensack River adjacent to Standard Chlorine and near the Cayuga Dike (upstream from Standard Chlorine). He commented that he has been lobbying federal and state agencies since 1997 to remediate the site to protect valuable wetlands and marshes located on the Hackensack River. His interest in the Standard Chlorine site is with respect to endangered species, such as Northern Harrier Hawks, Black Crowned Night Herons and Yellow Crowned Night Herons, who roost on the site.

As the Eco-Cruise boat tour proceeded down the Hackensack River, housing developments in Secaucus on former wetlands were shown. Several popular fishing locations were pointed out. Of the many marinas and boat launches located along the Hackensack River, only one of these launches is a public boat launch, located 0.5 miles upstream of the Standard Chlorine site in Laurel Hill Park. According to riverkeeper, this is a popular fishing location. People were observed sitting on the pier located in the park and two individuals were observed fishing from the shoreline in the park. Child playground equipment was observed in the park and the riverkeeper commented that it was a very popular recreational area for the local residents. The Standard Chlorine site was observed next. An abandoned boat is washed up on the shoreline and trash and rubbish were also observed. The southern outfall pipe had visible outflow into the Hackensack River. Other sites, downstream of the Standard Chlorine site were viewed next. Another popular fishing area observed during the Eco-Cruise is located 0.5 miles downstream at the confluence of Penhorn Creek and the Hackensack River. A makeshift fishing pier is located in this area.

On the way back to the marina, two people were observed on a powerboat cruising up and down the Hackensack River. According to the riverkeeper, the river is used by numerous boaters, jet skiers, canoers and kayakers. Captain Sheehan stressed that it is imperative that a barrier be installed along the Standard Chlorine site shoreline to prevent site-related contamination from entering the Hackensack River.

F. Community Concerns

In order to gather information on community health concerns at the Standard Chlorine site, the NJDHSS spoke with the Health Officer, Kearny Department of Health (J. Sarnas, Health Officer, Kearny Department of Health, personal communication, 2004). The local health department has reported no community concerns regarding the site. The USEPA and NJDEP do not indicate any community concerns on record.

A Hudson County community group, the Interfaith Community Organization, has voiced concerns in press about the Standard Chlorine site (Jones 2004; Lane, 2004a; 2004b). The project director for this organization, has expressed opinions with regard to clean-up of the site and advocates the cleaning up of the Hackensack River to be included as part of site clean-up. The community group's general concern is clean-up of sites in Hudson County that have received chromate fill in the past. The Standard Chlorine site is one of these sites, and the project director is particularly interested in chromium contamination on-site, especially with respect to air-borne chromium dust and the leaching of chromium into the Hackensack River.

ENVIRONMENTAL CONTAMINATION

A compilation of environmental sample results for the Standard Chlorine site dating from July 1983 through October 2002 is provided in the following section. Media reviewed included soil, sediment, groundwater and surface water. These data were organized by the NJDHSS as on-site (Standard Chlorine) versus off-site (Hackensack River, wetland area south of Standard Chlorine property). They were further categorized into contaminant type (chromium, volatile and semi-volatile organic compounds (VOCs/SVOCs)) in the reviewed media. There was no ambient air monitoring data available for review. The environmental sample results were then compared to the environmental comparison values detailed below. Typically the most stringent comparison value is used in the screening process to identify the contaminants of concern.

The ATSDR environmental comparison values include the Environmental Media Evaluation Guide (EMEG) or Reference Media Evaluation Guide (RMEG). EMEGs are estimated contaminant concentrations that are not expected to result in adverse non-carcinogenic health effects. RMEGs represent the concentration in water or soil at which daily human exposure is unlikely to result in adverse non-cancer health effects. When EMEGs or RMEGs were not available, the USEPA Region 3 Risk-Based Concentrations (RBCs) were used. RBCs are contaminant concentrations corresponding to a fixed level of risk (i.e., a Hazard Index of 1, or lifetime excess cancer risk of one in one million, whichever results in a lower contaminant concentration) in water, air, biota, and soil.

Additionally, the New Jersey Non-Residential Direct Contact Soil Clean-up Criteria (NRDCSCC) is provided for contaminants in soil. They are based on human health impacts but also take into consideration environmental impacts. For contaminants in sediment, the New Jersey Guidance for Sediment Quality Evaluations is provided although they are based upon ecological rather than human health risk. For contaminants in surface water and groundwater, health-based New Jersey Surface Water Quality Standards (NJSWQS) and New Jersey Groundwater Quality Standards (NJGQS) are provided.

On-Site Contamination

On-site is the area as defined in the site history section of this document. It includes the lagoon system and the open drainage ditch that originates in the center of the site (see Appendix A, Figure 2).

Soil Contaminants

Chromium

Soil data collected in 1991 indicate hexavalent chromium in the upper six inches of soil. The maximum concentration of hexavalent chromium in these samples was 270 mg/kg (see Appendix A, Table 1) which is above the RMEG (200 mg/kg). None of the samples collected below the Meadow Mat (located below two to 10 feet of COPR) contained hexavalent chromium above the detection limit. Total chromium concentrations in soil were more indicative of the known presence of chromium ore processing residue above the Meadow Mat. Total chromium concentrations exceeding 10,000 mg/kg were reported in a number of soil samples in the site fill; the highest reported concentration being 34,900 mg/kg, elevated above the RMEG and the NRDCSCC (see Appendix A, Table 1). However, none of the samples collected from below the Meadow Mat indicated elevated concentrations of total chromium; the highest reported concentration was 82 mg/kg collected at a depth of 13 feet below ground surface (Brown and Caldwell 2001).

VOCs/SVOCs

Surface soil samples in the former process area north of the lagoon system were collected for analysis during the remedial investigation completed by Weston (Weston 1993). The results of these analyses indicate the presence of 1,2-dichlorobenzene, 1,4-dichlorobenzene, the trichlorobenzene isomers, and naphthalene at elevated concentrations above the NRDCSCC and environmental comparison values (see Appendix A, Table 2). Concentrations of the polyaromatic hydrocarbons (PAHs) were greater than the NRDCSCC in these surface soil samples. Soil boring samples collected for VOCs/SVOCs analysis indicate that the soil contains elevated concentrations of 1,2-dichlorobenzene, 1,4-dichlorobenzene, the trichlorobenzene isomers and naphthalene above the NRDCSCC and environmental comparison values (see Appendix A, Table 3). The PAHs were similarly elevated in the soil boring samples. Elevated levels of lead and arsenic, higher than the NRDCSCC, were detected in soil borings in the western portion of the site (Weston 1993).

Soil samples collected for 2,3,7,8-TCDD analysis in 1985 indicated that dioxin was not present above the detection limit on the western portion of the site. However, concentrations of 2,3,7,8-TCDD collected from the eastern portion of the lagoon system area were elevated, with the maximum reported concentration being 0.0696 mg/kg (see Appendix A, Table 2). Dioxin samples collected within the lagoon system in 1987 indicated that dioxin was prevalent in these soils. The maximum reported 2,3,7,8-TCDD concentration in the soil within the lagoon system was 0.268 mg/kg (see Appendix A, Table 3). Both these maximum levels values exceed the environmental comparison value for TCDD (1.9×10^{-5} mg/kg).

Arochlor-1260, a polychlorinated biphenyl (PCB) congener, was detected at 9,300 mg/kg in concrete chips taken from the vicinity of the former transformer, in the western portion of the site. This concentration significantly exceeds the NRDCSCC of 2 mg/kg. It was found in lesser concentrations (0.12 to 0.29 mg/kg) in three soil samples collected directly beneath the concrete pavement, north of the former transformer (see Appendix A, Table 2).

Sediment Contaminants

Chromium

Total chromium levels were measured at detectable levels in the majority of sediment samples, collected from January 1991 through October 2002 (see Appendix A, Table 4). Total chromium was analyzed in numerous sediment samples across the site, including the drainage ditches and the lagoon system. The highest level (16,400 mg/kg) was detected in a sediment sample taken from the drain as it originates in the center of the site. Chromium, lead, arsenic, copper, mercury and zinc were elevated above the NRDCSCC and environmental comparison values (see Appendix A, Table 4).

VOCs/SVOCs

Sediment samples in the lagoon system area revealed the highest concentration of naphthalene (25,200,000 mg/kg) and phenols and PAHs, above the NRDCSCC (see Appendix A, Table 4). Additionally samples from the drainage ditch originating on-site had the highest levels of the dichlorobenzene isomers and trichlorobenzene, exceeding the environmental comparison values. The sample with the high PCB concentration (5,160 mg/kg) was collected near Building 2, near the former transformer pad (Weston 1993). The highest detected level of 2,3,7,8-TCDD (0.0595 mg/kg) was collected from the lagoon system area. Both these contaminants were detected at levels above the NRDCSCC and the environmental comparison values.

Surface Water Contaminants

Chromium

Sampling in the small drainage way along the eastern side of an abandoned railroad spur in the center of the site had the highest level of total chromium (1,240,000 µg/L). This exceeds the NJSWQS and the Maximum Contaminants Levels (MCLs). As presented in Table 5 in Appendix A, levels of mercury, lead and arsenic were also elevated above the environmental comparison values in the surface water samples.

VOCs/SVOCs

The maximum detected concentrations of the dichlorobenzene isomers were from a sample taken in the southern drainage ditch south of Building 2 (Weston 1993). These and other VOCs/SVOCs were present in the majority of the surface water samples, but at concentrations less than the environmental comparison values and standards (see Appendix A, Table 5). A review of the available data indicated that elevated levels of 2,3,7,8-TCDD have not been reported.

Groundwater Contaminants

Chromium

Since COPR is present throughout the site, levels of total chromium as well as hexavalent chromium are elevated above the NJGQS and MCLs in a majority of the monitoring wells, in both the shallow and deep zones. The highest detected hexavalent chromium (97,000 μg/L) was reported in the northeastern portion of the site. The same monitoring well had the maximum detected total chromium (101,700 μg/L). Additionally, as presented in Table 6 in Appendix A, all metals with the exception of cyanide, were also present at levels exceeding the environmental comparison values and standards in the groundwater.

VOCs/SVOCs

Based on the site's operational history, the VOCs/SVOCs concentrations are elevated and are generally higher in the area of the lagoon system, where process wastewaters were discharged (Brown and Caldwell 2001). With the exception of anthracene, all VOCs/SVOCs concentrations are above the various standards as summarized in Table 6 in Appendix A. Dioxin was reported at concentrations below the detection limit in monitoring wells located in the eastern portion of the site (Weston 1993).

Summary of On-Site Contaminants of Concern (COC)

The COC are those contaminants that are present at levels higher than the media-specific standards/criteria or the environmental comparison values. The COC present in on-site soil, sediment, surface water and groundwater are as follows:

VOCs	SVOCs		Metals
Benzene	1,2-Dichlorobenzene	Fluoranthene	Antimony
Chlorobenzene	1,3-Dichlorobenzene	Indeno(1,2,3-cd)pyrene	Arsenic
Methylene Chloride	1,4-Dichlorobenzene	Phenanthrene	Chromium
1,2-Trans-Dichloroethene	1,2,3-Trichlorobenzene	Naphthalene	Copper
1,1,2-Trichloroethane	1,2,4-Trichlorobenzene	Bis(2-ethylhexyl)phthalate	Lead
Trichloroethylene	Acenapthene	2-Chlorophenol	Mercury
Tetrachloroethylene	Acenaphthylene	2,4-Dichlorophenol	Nickel
Toluene	Benzo(a)anthracene	2,4-Dimethylphenol	Zinc
Vinyl chloride	Benzo(b)fluoranthene	2-Methylphenol	
Xylenes	Benzo(a)pyrene	4-Methylphenol	
	Benzo(g,h,i)perylene	Phenol	
	Chrysene	PCB – Arochlor 1260	
	Fluorene	2,3,7,8-TCDD (Dioxin)	

Off-Site Contamination

Off-site is defined as the Hackensack River adjacent to the site and the southern drainage ditch portion in the former Koppers property (see Appendix A, Figure 2).

Sediment and Surface Water Contaminants

Data from the analysis of sediment samples collected from the Hackensack River and the southern drainage ditch in the former Koppers property is summarized in Table 7 in Appendix A. The maximum levels of VOCs detected were below the sediment screening guidelines, the NRDCSCC and the environmental comparison values.

In the 27 samples collected from the Hackensack River by Enviro-Sciences in 2000, total chromium concentrations were generally above 1,000 mg/kg (Brown and Caldwell 2001). In the same study, hexavalent chromium was detected in three of the 27 samples ranging in concentration from 3.8 to 78.1 mg/kg (Enviro-Sciences, Inc. 2000). Each one of these positive detections was located in the riverbed at the northeast corner of the site, close to the north outfall.

The concentration of the dichlorobenzene isomers and trichlorobenzene exceeded the sediment screening guidelines but were below the NRDCSCC and the environmental comparison values. The PAHs (benzo(a)anthracene, benzo(b)fluoroanthene, benzo(a)pyrene, benzo(g,h,i)perylene) exceeded all comparison values (see Appendix A, Table 7). The maximum detected concentration of naphthalene (4,570 mg/kg) was detected in the Hackensack River close to the lagoon system area (Enviro-Sciences, Inc. 2000) and this exceeded the NRDCSCC and the environmental comparison value. Maximum detected concentrations of PCBs (0.21 mg/kg) and 2,3,7,8-TCDD (0.0000964 mg/kg) were detected above environmental comparison values, at the shoreline near the northern outfall and at the southern drainage ditch in the wetlands area of the former Koppers property, respectively (Enviro-Sciences, Inc. 2000, USEPA 2003).

Selected VOCs/SVOCs are present in the surface water samples at concentrations above the environmental comparison values and the NJSWQS (see Appendix A, Table 8).

Summary of Off-Site Contaminants of Concern (COC)

The COC present in off-site sediment and surface water are as follows:

VOCs	SVOCs		Metals
Benzene Chlorobenzene	1,2-Dichlorobenzene 1,3-Dichlorobenzene 1,4-Dichlorobenzene 1,2,4-Trichlorobenzene Benzo(a)anthracene Benzo(b)fluoranthene Benzo(a)pyrene	Benzo(g,h,i)perylene Indeno(1,2,3-cd)pyrene Phenanthrene Naphthalene PCB – Arochlor 1260 2,3,7,8-TCDD (Dioxin)	Arsenic Chromium (Total) Copper Lead Mercury

Basic toxicological information is provided in Appendix C for some of the most prevalent COC.

DISCUSSION

The general method for determining whether a public health hazard exists to a community is to determine whether there is a completed exposure pathway from a contaminated source to a receptor population. It is then determined whether levels of exposure due to contamination are high enough to be of public health concern. An evaluation of exposure pathways is presented in the following section.

Pathways Analysis

An exposure pathway is the process by which an individual is exposed to contaminants from a source of contamination and consists of the following five elements:

1) source of contamination;
2) fate and transport in environmental media (e.g., air, groundwater, surface water, soil, sediment, biota);
3) point of exposure (i.e., location of potential or actual human contact with a contaminated medium);
4) route of exposure (e.g., inhalation, dermal contact/absorption, ingestion); and
5) receptor population.

ATSDR/NJDHSS classifies exposure pathways into three groups: (1) completed pathways, that is, those in which exposure has occurred, is occurring, or will occur; (2) potential pathways, that is, those in which exposure might have occurred, may be occurring, or may yet occur; and (3) eliminated pathways, that is, those that can be eliminated from further analysis because one of the five elements is missing and will never be present, or in which no contaminants of concern can be identified.

The following table depicts the human pathway classification for the Standard Chlorine site:

Human Exposure Pathways Associated with the Standard Chlorine Site					
Pathway Name	Point of Exposure	Route of Exposure	Exposed Population	Time	Pathway Classification
Ambient Air	Standard Chlorine site	inhalation	on- and off-site worker populations, residential communities, site visitors, trespassers	Past Present Future	Potential
Surface Soil	Standard Chlorine site	skin contact, inhalation, ingestion	visitors to site, trespassers, workers on neighboring properties	Past Present Future	Potential
Sediment	Hackensack River, on-site drainage ditch, on-site lagoons	skin contact, ingestion	trespassers, recreational users of the river	Past Present Future	Potential
River Water	Hackensack River, on-site drainage ditch	skin contact, ingestion	recreational uses of the river	Past Present Future	Potential
Groundwater	Residences, tap	skin contact, inhalation, ingestion	Residents	Past Present Future	Eliminated
Food Chain (biota)	Hackensack River	ingestion	recreational fishing, crabbing	Past Present Future	Potential

Public Health Implications

Completed Pathways

Based on available information and site visit observations, there are no known completed human exposure pathways at the Standard Chlorine site. This is because the site is currently closed to entry from the land-bound side and no tissue concentrations of site-specific contaminants (chlorinated benzenes, naphthalene) in marine life in the Hackensack River are available at present. The recreational uses of the river are intermittent and therefore frequent significant exposures via this pathway are unlikely. Similarly, the exposures to trespassers and visitors to the site would be infrequent and would not likely result in large exposures to on-site contaminants. This pathway can be defined as plausible but infrequent at best.

Potential Pathways

Ambient air pathway

There is currently no community receptor population within one-mile of the Standard Chlorine site although there are residential communities beyond the one-mile radius. Additionally, future redevelopment of the site for non-industrial purposes may significantly modify population demographics. Due to lack of air monitoring data for the COC, it is difficult to determine the potential health impact of airborne contaminants to on- and off-site worker populations, residential communities living beyond the one-mile radius of the site, site visitors and trespassers.

Surface soil pathway

As described in the site visit section of this report, there were indications of trespassers/vandals at the Standard Chlorine site (e.g., broken windowpanes on buildings, evidence of rubbish/trash washed up on the Hackensack river bank). The potential for exposure to these individuals on a routine basis is unlikely and does not justify a completed exposure pathway designation. The nearest residential area is two miles to the west and it would require a determined trespasser to access the site from the Belleville Turnpike. The northern and the western portions of the Standard Chlorine site are fenced and gated; however, the eastern portion of the site adjacent to the Hackensack River is not secure against access from the river. Although it is unlikely that the public would utilize the Standard Chlorine shoreline for recreational purposes, it was noted in the site visit that this has happened in the past (example of an individual launching boat from the shoreline) and the possibility of unauthorized access to the site via the river cannot be dismissed.

River water/sediment/seafood pathways

Recreational activities associated with the Hackensack River (i.e., fishing, boating) may be associated with an exposure pathway linked to the Standard Chlorine site. Seasonally, activities such as canoeing, kayaking, the use of small power boats and personal water crafts (i.e., jet-skiing) occur along this stretch of the Hackensack River. Laurel Hill park located on the Kearny dike, approximately half a mile upstream (see Appendix A, Figure 5) has a free public boat launch used by as many as 100 boats a day during the summer months (Captain B. Sheehan, the Hackensack Riverkeeper, personal communication, 2004). There are other independent recreational users of the Hackensack River, including charter companies and canoe/kayak clubs. As stated previously, recreational uses of the Hackensack River are intermittent and therefore frequent significant exposures via ingestion of sediment/surface water are unlikely.

Due to PCB and dioxin contamination, originating in part from the Standard Chlorine site, Fish Consumption Advisories pertaining to the consumption of some fish and blue crab have been issued for the Hackensack River. There is no commercial fishing on the Hackensack River. There are small operations that gather bait fish such as banded killifish and mummichog on a sporadic basis (Captain B. Sheehan, the Hackensack Riverkeeper, personal communication, 2004; Jim Joseph, NJDEP, personal communication, 2004). While no fisheries are designated as closed, this Advisory has been issued for the Hackensack River regarding the consumption of blue crab and striped bass due to dioxin contamination; and American eel, white perch, and white catfish due to PCB contamination in the river. The Hackensack River advisory is included as part of the Newark Bay complex advisory (NJDEP 2003; USEPA 2003).

Despite the Fish Consumption Advisories, fishing for consumption regularly takes place on the Hackensack River. There are two popular fishing locations on the banks of the river both 0.5 miles upstream and downstream from Standard Chlorine site. One location is on the Kearny dike in Laurel Hill County park and the other location is near the confluence of the Penhorn Creek and the Hackensack River (see Appendix A, Figure 5 and 6). Other popular fishing locations include Cayuga Dike (just upstream of the site), Mill Creek (five miles upstream from Laurel Hill County park), the Flats in Newark Bay, and the Ledge (near the Jersey Gardens Mall at the confluence of Newark Bay, the Kill Van Kull, and the Arthur Kill). The Hackensack River has gained in popularity for recreational fishing in recent years due to the presence of more than 60 species of fish in the river. Additionally, increased ferry traffic on the Hudson River, a neighboring river in this region, has made it harder to fish in small boats (Captain B. Sheehan, Hackensack Riverkeeper, personal communication, 2004). This has made the Hackensack River the more popular choice amongst recreational anglers.

There have been two major studies conducted by the NJDEP in 1985 and 1988, examining 2,3,7,8,-TCDD contamination in marine life in New Jersey waterways and the New York Bight, respectively (NJDEP 1985-1988). These studies are part of a statewide "Routine Monitoring Program for Toxics in Fish" developed to provide current and more comprehensive data on concentrations of toxic contaminants in fish and shellfish in order to assess human health risks and thus update/recommend fish consumption advisories gather data for advisories. The NJDEP and the NJDHSS through the interagency Toxics in Biota Committee review results from these studies to set statewide fish advisories and consumption levels. Although the dioxin levels in the Hackensack River cannot be solely attributed to Standard Chlorine, the studies indicate widespread dioxin contamination in the Newark Bay (the confluence of the Passaic and Hackensack rivers).

Two studies initiated in 2004 will characterize the bioaccumulation of dioxins, PCBs, PAHs (including naphthalene), selected pesticides, furans and chlorinated benzene compounds in fish and crab (B. Ruppel, NJDEP, personal communication, 2004; NJDEP 2004; E. Konsevick, New Jersey Meadowlands Commission, personal communication, 2004) in the Newark Bay complex, including the Hackensack River. These studies may allow an estimation of the contribution of site-related contaminants to localized biota and therefore to estimates of exposures via ingestion of edible marine life. The results of these studies in conjunction with river sediment evaluations may enable a quantitative attribution of an exposure dose from the Standard Chlorine site.

Migration Pathways from On- to Off-Site Areas

There are three areas of particular concern with regard to migration of on-site contaminants to off-site areas (the Hackensack River and the wetlands area of the former Koppers property). These are described as follows:

Lagoon System

The lagoon system was constructed on the eastern portion of the site in the mid-1940s and the eastern end is located approximately 25 feet from the Hackensack River shoreline. The lagoon system is unlined and the base of the waste material is in contact with the water table and the sides of the depression are chromium fill, the high permeability of which disperses drainage. Residual waste materials in the lagoons consist of sludge and viscous oils associated with sludge, and residual solids. The sludge is typically black and viscous and the chemical composition of the sludge has been identified from the analyses of four sludge samples collected as part of the Weston Remedial Investigation (RI) Report. The major constituent in each of the samples was naphthalene, which accounted for between 30 and almost 99 percent of the sample content (Weston 1993). Dioxin sampling events in February and March 1987 showed that contamination of 2,3,7,8-TCDD existed throughout the vertical extent of the waste material in the lagoons and across most of the horizontal extent of the lagoons (Weston 1993; Brown and Caldwell 2001).

Because the waste lagoon system is unlined and the base of the waste is below the elevation of the shallow groundwater table, the lagoon system currently represents the principal potential source of contaminant releases at the site, considering the relatively high concentration of constituents detected in the lagoon system sludges.

South Drainage Ditch

The southern drainage ditch received flow from drainage ways near Buildings 2, 3 and 4 in the southwestern portion of the site (see Appendix A, Figure 2). The southern drainage ditch also receives flow from the shallow groundwater. Shallow groundwater flows laterally in the sand unit and discharges to the southern drainage ditch and ultimately to the Hackensack River. The sediments in the drainage ditch were observed to have a yellow-brown color forming a scum on the water surface (USEPA 2003). While it is possible that surface water and sediments in the southern drainage ditch may be impacted from contaminants from the Koppers property to the south of the site, the highest concentration of contaminants were detected in the center of the Standard Chlorine property where the ditch originates on-site. The contaminants detected in the surface water and sediment samples collected in the southern drainage ditch are all site-attributable compounds.

Under New Jersey Pollutant Discharge Elimination System (NJPDES) Discharge to Surface Water Permit, Standard Chlorine was permitted to discharge septic tank overflow, boiler blow down and stormwater runoff into the southern drainage ditch. Standard Chlorine was found in violation of the Spill Compensation and Control Act and the Water Pollution Control Act as stated in the Administrative Consent Order issued by the NJDEP and signed by NJDEP and Standard Chlorine on 20 October and 18 October, 1989, respectively (NJDEP 1989). The violations were issued for the past and current discharges of hazardous substances and pollutants into the waters and onto the lands of the State of New Jersey (NJDEP 1989). Additionally, during the October 2002 USEPA sampling event, a seep was observed entering the Hackensack River from the sediment nine feet to the southeast of the outfall where the southern drainage ditch confluences with the Hackensack River. The seep was black and chemical analysis of the seep documented the presence of 1,4-dichlorobenzene (USEPA 2003).

Both of these incidents document that site related hazardous substances from the site have directly entered the Hackensack River.

Soils

Soil boring samples taken at both the western and eastern portions of the site showed elevated levels of chlorobenzene, dichlorobenzene isomers, trichlorobenzene isomers and naphthalene. This may be the result of leakage or spillage from aboveground storage tanks, or migration of contaminants from the lagoons through the soils (Environmental Resources Management 1997; Weston 1993). Additionally the Standard Chlorine site has extensive Dense Non-Aqueous Phase Liquid (DNAPL) contamination (Key Environmental 1999). DNAPL is a liquid that is denser than water and does not dissolve or mix easily in water (it is immiscible). DNAPL contamination is problematic because of the high density of DNAPLs relative to water; thus, they will tend to migrate to considerable depths in an aquifer until reaching a low permeability zone that will retard further downward movement.

As part of a 1999 study by Key Environmental, samples collected in the eastern part of the site had a DNAPL composition of primarily dichlorobenzene isomers, naphthalene and trichlorobenzene isomers. Significant DNAPL migration appears to have occurred from Buildings 2, 3 and 4 areas to the southwestern part of the site (Key Environmental 1999). For samples collected in the vicinity of Buildings 2, 3 and 4, the DNAPL is believed to be comprised of primarily of the dichlorobenzene isomers. The DNAPL appears to have migrated along the top of clay unit to the northeast and the northwest and was also observed to be present south of the lagoon system.

DNAPLs present potential continuing sources of dissolved-phase chemical compounds to groundwater. The most significant migration pathway for groundwater within the fill/Meadow Mat unit is flow to the drainage ditch along the southern property boundary, and to the stormwater drainage pipe along the northern property boundary, ultimately draining into the Hackensack River. The primary migration pathway for groundwater in the sand unit is to the south with discharge to the Hackensack River.

Based on these presented migration pathways, it appears that the soils and free phase product in the vicinity of Building 2 are a continuing source of contamination to the Hackensack River.

Eliminated Pathways

The groundwater ingestion pathway has been eliminated because there are no known wells used for private or public drinking water supply located within one-mile of the site (Weston 1993). In addition, a well search conducted for another NPL site located less than two miles west of the Standard Chlorine site revealed no wells within four miles of that site (ATSDR 2002). No drinking water intakes are located in this portion of the Hackensack River. Hudson County's drinking water is supplied by four different purveyors which are the Passaic Valley Water Commission, United Water Company, United Water New Jersey, and North Jersey District Water Supply Commission. The primary sources of potable water are from watersheds outside of the county, including the Oradell Reservoir in Bergen County, New Jersey, and the Wanaque Reservoir, Passaic County, New Jersey (United Water New Jersey 2002). The Town of Kearny receives its drinking water supply from the Wanaque Reservoir in Bergen County (R. Ferraioli, Hudson County Water Department, personal communication, 2004; United Water New Jersey 2002).

Health Outcome Data

Based on currently available data, there were no identified completed exposure pathways associated with the site, therefore no health outcome data for those living in the area closest to the Standard Chlorine site was evaluated at this time. In the past (from January 1992 through September 1993), the NJDHSS designed and conducted a screening project to determine potential exposures to people living and/or working near chromium waste sites in Hudson and Essex counties. This project, named the Chromium Medical Surveillance Project (CMSP), included the workers at the Standard Chlorine site as part of 78 workplaces targeted for screening services. The NJDHSS designed this project determine if exposure to chromium was occurring and to provide medical evaluations to people who live and/or work on or near chromium waste sites. Most of the persons undergoing the follow-up medical examinations revealed no apparent clinical effects attributable to chromium exposure. However, for six persons, chromium was suspected to be a possible cause or contributing factor in their clinical conditions. The CMSP found little evidence of clinically observable chromium-induced health effects, but found evidence of low levels of exposure to chromium among some participants living and/or working in the vicinity of chromium waste sites, including adult workers at the Standard Chlorine site (New Jersey Department of Health 1994).

CHILD HEALTH CONSIDERATIONS

ATSDR recognizes that the unique vulnerabilities of infants and children demand special emphasis in communities faced with contamination in their environment. Children are at greater risk than adults from certain kinds of exposures to hazardous substances because they eat and breathe more than adults (on a pound for pound basis). They also play outdoors and often bring food into contaminated areas. They are shorter than an adult, which means they breathe dust, soil, and heavy vapors closer to the ground. Children are also smaller, resulting in higher doses of chemical exposure per body weight. The developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages. Most important, children depend completely on adults for risk identification and management decisions, housing decisions, and access to medical care.

Currently there are no residents living within a mile of the Standard Chlorine site. However, the Hackensack River is used seasonally for recreational activities such as fishing, crabbing, jet-skiing and inner-tubing by families. Although this does not represent a completed exposure pathway, there is potential for incidental ingestion of contaminants in surface water, biota and river sediment. It is not expected that small children would be able to gain access to the Standard Chlorine site.

CONCLUSIONS

The Public Health Hazard Category recommended for the Standard Chlorine site is ***"Indeterminate Public Health Hazard"*** for the biota and ambient air pathways. Data associated with the biota pathway is not currently available and this pathway is the most significant pathway of exposure associated with the site, partly due to the possibility of repeated exposures. There are two popular fishing locations on the banks of the river both 0.5 miles up and downstream from Standard Chlorine and hook and line fishing from boats takes place on the Hackensack River off the Standard Chlorine property. Despite the recommendations of the Fish Consumption Advisory, fishing and crabbing for consumption continues to occur. Two studies were initiated in 2004 that will characterize the bioaccumulation of dioxins, PCBs, PAHs (including naphthalene), selected pesticides, furans and chlorinated benzene compounds in fish and crab in the Newark Bay complex, including the Hackensack River. The results of these studies may enable the NJDHSS, in cooperation with the ATSDR, to evaluate the contribution of site-related contamination to the biota pathway. There is currently no community receptor population within one-mile of the Standard Chlorine site although there are residential communities beyond the one-mile radius. Additionally, future redevelopment of the site for non-industrial purposes may significantly modify population demographics. Due to lack of air monitoring data for the COC, it is difficult to determine the potential health impact of airborne contaminants to on- and off-site worker populations, residential communities living beyond the one-mile radius of the site, site visitors and trespassers.

The Hackensack River is utilized by families for seasonal recreational activities such as kayaking, canoeing and the use of personal water crafts (i.e., jet skiing). The recreational uses of the Hackensack River are intermittent and therefore frequent significant exposures via ingestion of sediment/surface water are unlikely. The site is potentially accessible to trespassers from the shore-bound side. As stated in the pathway analysis section, the potential for exposure to these individuals on a routine basis is unlikely. Overall, the likelihood of frequent, significant exposures to the contaminants of concern via the trespassers and recreational uses of the river pathways is unlikely. Therefore, the Public Health Hazard Category recommended for these pathways is ***"No Apparent Public Health Hazard"***.

The Standard Chlorine site has complex environmental contamination such as dioxin-contaminated asbestos consolidated into sea boxes, dioxin-contaminated buildings in the former processing area north of the lagoon system, DNAPL contamination on-site which acts as a potential continuing source of dissolved-phase chemical compounds to groundwater. The on-site contamination of soil, sediment, surface water and ground water is present at levels well above environmental comparison values. The contaminants detected in the surface water and sediment samples collected in the southern drainage ditch are all site-attributable compounds. The contaminated surface and sub-surface soils on-site impact the surface water and groundwater through sediment transport in the surface and leaching of contaminants to the groundwater. The most significant migration pathway for groundwater is flow to the drainage ditch along the southern property boundary, and to the stormwater drainage pipe along the northern property boundary, ultimately draining into the Hackensack River. Another fraction of the groundwater discharges directly to the Hackensack River. Additionally, during the October 2002 USEPA sampling event, a seep was observed entering the Hackensack River from the sediment southeast of the southern outfall. Without extensive remedial action, the on-site contaminants of concern would represent a potential public health concern if conditions or land use at the site change, resulting in future exposures.

RECOMMENDATIONS

1. The Hackensack River is likely to be impacted by surface water run-off and groundwater discharge into the river and the potential impact on biota in the river is currently being evaluated by the NJDEP. It is recommended to the USEPA to reduce migration of on-site contaminants to the Hackensack River.

2. Given that groundwater present under the Standard Chlorine site discharges to the Hackensack River, hydrogeological investigations by the USEPA and/or potential responsible party(ies) to characterize the direction and extent of contaminant migration from the site to off-site areas are recommended. This distributional data will aid in the evaluation of the contribution of the Standard Chlorine site to the overall contaminant burden currently present in the Hackensack River.

3. As discussed in the Background section of this report, there are currently no individuals residing within a one-mile radius of the site although there are residential communities beyond the one-mile radius. As such, air monitoring designed to evaluate the impacts from site related contaminants should be conducted by the NJDEP (or by the appropriate environmental regulatory agency).

4. There are or will be remediation workers at the Standard Chlorine site and/or neighboring properties. Additionally, future redevelopment of the site for non-industrial purposes may significantly modify population demographics. It is recommended that air monitoring by the appropriate environmental regulatory agency be implemented during remedial activities to determine the potential health impact of airborne contaminants to both on- and off-site worker populations.

5. As site conditions change, public health implications and the potential for completed human exposure pathways will be reevaluated and the current designated Hazard Category will be reconsidered.

PUBLIC HEALTH ACTION PLAN

The Public Health Action Plan (PHAP) for the Standard Chlorine site contains a description of the actions to be taken by the NJDHSS and/or ATSDR at or in the vicinity of the site subsequent to the completion of this Public Health Assessment. The purpose of the PHAP is to ensure that this health assessment not only identifies public health hazards, but provides a plan of action designed to mitigate and prevent adverse human health effects resulting from exposure to hazardous substances in the environment. Included is a commitment on the part of the NJDHSS and ATSDR to follow up on this plan to ensure that it is implemented. The public health actions to be implemented by NJDHSS and ATSDR are as follows:

Public Health Actions Taken

1. Available environmental data and other relevant information for the Standard Chlorine site have been reviewed and evaluated to determine human exposure pathways and public health issues.

2. Despite current Fish Consumption Advisories, some individuals continue to consume the fish and crabs caught/trapped from the Hackensack River. An education and outreach effort by the NJDEP, the Department of Agriculture and the NJDHSS commenced in April 2004 (as part of Routine Monitoring Program for Toxics in Fish study) to determine the basis for non-compliance, to educate anglers and community members the importance of fish advisories and the health effects associated with eating contaminated fish (NJDEP 2004b).

Public Health Actions Planned

1. Hackensack River fish tissue studies are currently underway by the NJDEP. When the final report is available, the NJDHSS, in cooperation with the ATSDR, will review the data to evaluate the contribution of site-related contamination to the biota pathway.

2. Discussions with regional angler communities are planned by the NJDEP to present available education and outreach information and, more importantly, identify locations where fishing for consumption regularly takes place despite posted fish consumption advisories. Pilot projects, in conjunction with angler surveys, are being planned to identify effective means of communicating advisories, fishing bans, and health risks associated with fish and shellfish obtained from the Newark and Raritan Bays, and the Hackensack and Passaic Rivers (K. Kirk-Pflugh, NJDEP, personal communication, 2004).

3. The ATSDR and the NJDHSS will review and evaluate any community health concerns which may arise. A public availability session is not currently planned for this site. A public availability session to gather community concerns and comments will be held in the future if a need is indicated.

4. New environmental, toxicological, or health outcome data, or the results of implementing the above proposed actions, may determine the need for additional actions at this site. The ATSDR and the NJDHSS will reevaluate and expand the PHAP as warranted.

REFERENCES

ATSDR. Public Health Assessment for Diamond Head Oil Refinery Division Site, Kearny, Hudson County, New Jersey. Atlanta: US Department of Health and Human Services; 2002

Brown and Caldwell, 2001. Addendum to Volume IIA Remedial Investigation (RI) Workplan New Jersey Department of Environmental Protection Site Identification No. 116 (Standard Chlorine)

E.C. Jordan Co., 1985. Phase II Dioxin Site Investigation – Final Report Standard Chlorine Chemical Company as submitted to New Jersey Department of Environmental Protection

Environmental Resources Management, 1997. Focused Remedial Investigation (FRI) Report for the Standard Chlorine Chemical Company, Inc. and Standard Naphthalene Products Inc. Properties

Enviro-Sciences, 2000. Remedial Action Workplan for the Standard Chlorine Company, Inc.

Key Environmental, Inc., 1999. Supplemental Remedial Investigation prepared for Standard Chlorine Chemical Co., Inc.

Key Environmental, Inc., 2003. Interim Remedial Measures Workplan for Standard Chlorine Chemical Co., Inc.

Jones, R.L., 2004. Cleanup of site near Kearny may become EPA Project. The New York Times 2004 April 8; Section B , Page 5 , Column 5. Available from: URL: http://www.gsenet.org/library/11gsn/2004/gs040409.php#CAMPBELL%20MAY%20RECOMMEND%20KEARNY%20SITE%20FOR%20SUPERFUND%20LIST

Lane, A., 2004(a). Development plans worry enviro-experts. The Star Ledger 2004 April 7. Available from: URL: http://www.gsenet.org/library/11gsn/2004/gs040408.php#POISONED%20NJ%20SITE%20IS%20KEPT%20OFF%20EPA'S%20LIST and http://www.nj.com/search/index.ssf?/base/news-1/1081513509212890.xml?starledger?ntr

Lane, A., 2004(b). New alarm over chromium "hot spots'. The Star ledger 2004 April 20. Available from: URL: http://www.nj.com/search/index.ssf?/base/news-14/108244274772980.xml?starledger?ntop and http://www.nj.com/kearnyjournal/index.ssf?/base/news-1/1081415659290320.xml

New Jersey Department of Environmental Protection (NJDEP), 1989. Administrative Consent Order In The Matter of Standard Chlorine Chemical Corporation, Kearny, New Jersey, October 20, 1989

New Jersey Department of Environmental Protection (NJDEP), 2004(a). Draft Workplan – Routine Monitoring Program for Toxics in Fish: Estuarine and Marine Waters. Available from: URL: http://www.state.nj.us/dep/dsr/draft-workplan.htm

New Jersey Department of Environmental Protection (NJDEP), 2004(b). Routine Monitoring Program for Toxics in Fish: Estuarine and Marine Waters. Available from: URL: http://www.state.nj.us/dep/dsr/monitorplan.htm and http://www.gsenet.org/library/11gsn/2004/gs040408.php#$550K FOR TOXIC CONTAMINANTS STUDY OF NJ's FISH

New Jersey Department of Environmental Protection (NJDEP), 2003. Public Health Advisories and Guidance on Fish Consumption for Recreational Fishing: 2003 Fish Consumption Advisories for PCBs and Dioxin. Available from: URL: http://www.nj.gov/dep/dsr/fish_pcb.pdf

New Jersey Department of Environmental Protection (NJDEP), 1985; 1988. Dioxin Reports. Available from: URL: http://www.state.nj.us/dep/dsr/dioxin/index.htm

New Jersey Department of Health (NJDOH), 1994. Chromium Medical Surveillance Project – Final Technical Report. Environmental Health Services; October 1994. Available from: URL: http://www.state.nj.us/health/eoh/hhazweb/crsumm.pdf

United States Environmental Protection Agency (USEPA), 2003. HRS Documentation Record for Standard Chlorine Chemical Company, Inc. Available from: URL: http://www.epa.gov/superfund/sites/docrec/pdoc1672.pdf

United Water New Jersey, 2002. Consumer Confidence Report 2002 (Issued June 2003). Available from: URL: http://www.unitedwater.com/uwnj/pdfs/NJersey.pdf and http://www.hudsoncountynj.org/downloads/masterplan/chapter8x.pdf

Weston, 1993. Remedial Investigation for the Standard Chlorine Chemical Company, Inc. and Standard Naphthalene Products Inc. Properties

Preparers of Report:

Somia Aluwalia, M.S., Ph.D.
Research Scientist III

Julie R. Petix, M.P.H., C.P.M., H.O.
Health Assessment Project Manager

Steven M. Miller, Ph.D.
Environmental Scientist II

Tariq Ahmed, Ph.D., P.E.
Research Scientist II

ATSDR Regional Representatives:

Arthur Block
Senior Regional Representative

Leah T. Escobar, R.S.
Associate Regional Representative

ATSDR Technical Project Officer:

Gregory V. Ulirsch, M.S.
Technical Project Officer
Superfund Site Assessment Branch
Division of Health Assessment and Consultation

Any questions concerning this document should be directed to:

Julie R. Petix, M.P.H., C.P.M., H.O.
Health Assessment Project Manager
New Jersey Department of Health and Senior Services
Division of Epidemiology, Environmental and Occupational Health
Consumer and Environmental Health Services
3635 Quakerbridge Road
P.O. Box 369
Trenton, New Jersey 08625-0369

CERTIFICATION

The Public Health Assessment for the Standard Chlorine Chemical Company, Kearny, New Jersey, was prepared by the New Jersey Department of Health and Senior Services under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the public health assessment was initiated.

Gregory V. Ulirsch
Technical Project Officer, SPAB, DHAC
Agency for Toxic Substances and Disease Registry (ATSDR)

The Division of Health Assessment and Consultation (DHAC), ATSDR, has reviewed this Health Consultation and concurs with its findings.

Roberta Erlwein
Team Leader, CAT, SPAB, DHAC, ATSDR

APPENDIX A

Table 1
Standard Chlorine Chemical Company - On-Site Soil Contaminants
Data from Chromium Sampling Events Conducted between July 1983 - January 1991

Metals, PCBs and Dioxin	Soil Depth (feet)	Maximum Detected Concentration (mg/kg)	NJ Non-Residential Direct Contact Soil Cleanup Criteria (NRDCSCC) (mg/kg)	Environmental Comparison Value (mg/kg)
Chromium (Total)	**0 - 0.5**	**18,800**	6,100*	not available
	0.6 - 7	**34,900**		
	12 - 19	82		
Chromium (Hexavalent)	**0 - 0.5**	**270**	6,100	200 (RMEG†)
	0.6 - 7	38		

* Criterion based on the ingestion exposure pathway for hexavalent chromium
† Reference Media Evaluation Guide
Contaminants of Concern are in boldface

Table 2
Standard Chlorine Chemical Company - On-Site Soil Contaminants
Data from Sampling Events Conducted between May 1985 - October 1998
Soil Depth 0 - 2 feet

Volatile Organic Compounds	Maximum Detected Concentration (mg/kg)	NJ Non-Residential Direct Contact Soil Cleanup Criteria (NRDCSCC) (mg/kg)	Environmental Comparison Value (mg/kg)
Chlorobenzene	99.6	680	800 (EMEG*)
Tetrachloroethylene	2.30	6	500 (RMEG†)
Methylene Chloride	7.02	210	90 (CREG‡)
Trichloroethylene	0.866	54	7.2 (RBC§) C
1,2-trans-dichloroethene	0.0765	1,000	400 (EMEG)
Semi-Volatile Organic Compounds	**Maximum Detected Concentration (mg/kg)**	**NJ Non-Residential Direct Contact Soil Cleanup Criteria (NRDCSCC) (mg/kg)**	**Environmental Comparison Value (mg/kg)**
1,2-Dichlorobenzene	**6,470**	10,000	5,000 (RMEG)
1,3-Dichlorobenzene	1550	10,000	31,000 (RBC) N
1,4-Dichlorobenzene	**4,840**	10,000	120 (RBC) C
1,2,3-Trichlorobenzene	**0.0326**	not available	not available
1,2,4-Trichlorobenzene	**200,000**	1,200	500 (RMEG)
Anthracene	46.2	10,000	20,000 (EMEG)
Acenapthene	219	10,000	1,000 (EMEG)
Benzo(a)anthracene	1.5	4	3.9 (RBC) C
Benzo(b)fluoranthene	**65.8**	4	3.9 (RBC) C
Benzo(a)pyrene	**34.1**	0.66	0.1 (CREG)
Benzo(g,h,i)perylene	**31.4**	not available	not available
Bis (2-Ethylhexyl) phthalate	220	210	50 (CREG)
Di-n-octyl phthalate	190	10,000	800 (EMEG)
Chrysene	**41.9**	40	390 (RBC) C
Fluorene	213	10,000	800 (EMEG)
Fluoranthene	121	10,000	800 (EMEG)
Indeno(1,2,3-cd)pyrene	**35.9**	10,000	3.9 (RBC) C
Phenanthrene	**428**	not available	not available
Pyrene	70.5	10,000	2,000 (RMEG)
Naphthalene	**2,370,000**	4,200	40 (EMEG)
2,3,7,8-TCDD (Dioxin)	**0.0696**	not available	1.9×10^{-5} (RBC) C
PCB - Arochlor 1260**	**9,300**	2	1.4 (RBC) C

* Environmental Media Evaluation Guide
† Reference Media Evaluation Guide
‡ Cancer Risk Evaluation Guide for 1×10^{-6} excess cancer risk
§ Risk Based Concentration (N: Non carcinogenic effects; C: Carcinogenic effects)
** sample collected is a concrete chip
Contaminants of Concern are in boldface

Table 3

Standard Chlorine Chemical Company - On-Site Soil Contaminants
Data from Sampling Events Conducted between May 1985 - January 1999
Soil Depth > 2 feet

Volatile Organic Compounds	Maximum Detected Concentration (mg/kg)	NJ Non-Residential Direct Contact Soil Cleanup Criteria (NRDCSCC) (mg/kg)	Environmental Comparison Value (mg/kg)
Chlorobenzene	220	680	800 (EMEG*)
Chloromethane	0.180	1,000	not available
Tetrachloroethylene	**16**	6	500 (RMEG†)
Semi-Volatile Organic Compounds	**Maximum Detected Concentration (mg/kg)**	**NJ Non-Residential Direct Contact Soil Cleanup Criteria (NRDCSCC) (mg/kg)**	**Environmental Comparison Value (mg/kg)**
1,2-Dichlorobenzene	**9,200**	10,000	5,000 (RMEG)
1,3-Dichlorobenzene	1,700	10,000	31,000 (RBC‡) N
1,4-Dichlorobenzene	**1,630**	10,000	120 (RBC) C
1,2,3-Trichlorobenzene	**2,140**	not available	not available
1,2,4-Trichlorobenzene	**6,540**	1,200	500 (RMEG)
Anthracene	90	10,000	20,000 (EMEG)
Acenapthene	25	10,000	1,000 (EMEG)
Benzo(a)anthracene	**87**	4	3.9 (RBC) C
Benzo(b)fluoranthene	**58**	4	3.9 (RBC) C
Benzo(a)pyrene	**82**	0.66	0.1 (CREG§)
Benzo(g,h,i)perylene	**53**	not available	not available
Bis (2-Ethylhexyl) phthalate	9.92	210	50 (CREG)
Di-n-butyl phthalate	3.06	10,000	800 (EMEG)
Chrysene	**79**	40	390 (RBC) C
Fluorene	33	10,000	800 (EMEG)
Fluoranthene	200	10,000	800 (EMEG)
Indeno(1,2,3-cd)pyrene	**54**	10,000	3.9 (RBC) C
Phenanthrene	**200**	not available	not available
Pyrene	190	10,000	2,000 (RMEG)
Naphthalene	**5,750**	4,200	40 (EMEG)
2,3,7,8-TCDD (Dioxin)	**0.268**	not available	1.9×10^{-5} (RBC) C
Metals	**Maximum Detected Concentration (mg/kg)**	**NJ Non-Residential Direct Contact Soil Cleanup Criteria (NRDCSCC) (mg/kg)**	**Environmental Comparison Value (mg/kg)**
Lead	**647**	600	not available
Arsenic	**41.9**	20	0.5 (CREG)
Copper	**335**	600	60 (EMEG)

* Environmental Media Evaluation Guide

† Reference Media Evaluation Guide

‡ Risk Based Concentration (N: Non carcinogenic effects; C: Carcinogenic effects)

§ Cancer Risk Evaluation Guide for 1×10^{-6} excess cancer risk

Contaminants of Concern are in boldface

Table 4
Standard Chlorine Chemical Company - On-Site Sediment Contaminants
Data from Sampling Events Conducted between January 1991 - October 2002

Volatile Organic Compounds	Maximum Detected Concentration (mg/kg)	Freshwater Sediment Screening Guidelines (mg/kg)	NJ Non-Residential Direct Contact Soil Cleanup Criteria (NRDCSCC) (mg/kg)	Environmental Comparison Value (mg/kg)
Benzene	**23.4**	0.34	13	52 (RBC*) C
Chlorobenzene	250	not available	680	800 (EMEG[†])
Toluene	**63.1**	2.5	1,000	40 (EMEG)
Methylene Chloride	21.5	not available	210	90 (CREG[‡])
Ethylbenzene	43.3	1.40	1,000	5,000 (RMEG[§])
Semi-Volatile Organic Compounds	**Maximum Detected Concentration (mg/kg)**	**Freshwater Sediment Screening Guidelines (mg/kg)**	**NJ Non-Residential Direct Contact Soil Cleanup Criteria (NRDCSCC) (mg/kg)**	**Environmental Comparison Value (mg/kg)**
1,2-Dichlorobenzene	**5,300**	0.035	10,000	5,000 (RMEG)
1,3-Dichlorobenzene	3,900	not available	10,000	31,000 (RBC) N
1,4-Dichlorobenzene	**6,000**	0.11	10,000	120 (RBC) C
1,2,4-Trichlorobenzene	**2,900**	not available	1,200	500 (RMEG)
2,4-Dimethylphenol	**21,900**	not available	10,000	1,000 (RMEG)
Anthracene	1,700	0.22	10,000	20,000 (EMEG)
Acenapthene	**6,070**	0.02	10,000	1,000 (EMEG)
Benzo(a)anthracene	1.1	0.32	4	3.9 (RBC) C
Benzo(b)fluoranthene	**44.6**	0.24	4	3.9 (RBC) C
Benzo(a)pyrene	**37.7**	0.37	0.66	0.1 (CREG)
Benzo(g,h,i)perylene	**36.2**	0.17	not available	not available
Bis (2-Ethylhexyl) phthalate	**188**	not available	210	50 (CREG)
Chrysene	33.6	0.34	40	390 (RBC) C
Fluorene	**5,150**	0.19	10,000	800 (EMEG)
Fluoranthene	**903**	0.75	10,000	800 (EMEG)
Indeno(1,2,3-cd)pyrene	**48.3**	0.20	10,000	3.9 (RBC) C
Naphthalene	**25,200,000**	0.16	4,200	40 (EMEG)
Phenanthrene	**5,320**	0.56	not available	not available
Pyrene	663	0.49	10,000	2,000 (RMEG)
PCB - Arochlor 1260	**5,160**	0.005	2	1.9×10^{-5} (RBC) C
2,3,7,8-TCDD (Dioxin)	**0.0595**	not available	not available	1.4 (RBC) C
Metals	**Maximum Detected Concentration (mg/kg)**	**Freshwater Sediment Screening Guidelines (mg/kg)**	**NJ Non-Residential Direct Contact Soil Cleanup Criteria (NRDCSCC) (mg/kg)**	**Environmental Comparison Value (mg/kg)**
Chromium (Total)	**16,400**	26	6,100**	not available
Lead	**15,500**	31	600	not available
Arsenic	**30**	6	20	0.5 (CREG)
Copper	**401**	16	600	60 (EMEG)
Mercury	**25**	0.2	270	not available
Cyanide	99	not available	21,000	1,000 (RMEG)
Zinc	**1,850**	120	1,500	600 (EMEG)

* Risk Based Concentration (N: Non carcinogenic effects; C: Carcinogenic effects)

[†] Environmental Media Evaluation Guide

[‡] Cancer Risk Evaluation Guide for 1×10^{-6} excess cancer risk

[§] Reference Media Evaluation Guide

** Criterion based on the ingestion exposure pathway for hexavalent chromium

Contaminants of Concern are in boldface

Table 5
Standard Chlorine Chemical Company - On-Site Surface Water Contaminants
Data from Sampling Events Conducted between January 1991 - October 2002

Volatile Organic Compounds	Maximum Detected Concentration (µg/L)	NJ Class SE-2 Surface Water Quality Standards (µg/L)	NJ Maximum Contaminant Levels (µg/L)	Environmental Comparison Value (µg/L)
Benzene	**40**	71	1	0.6 (CREG*)
Chlorobenzene	**600**	21,000	not available	200 (RMEG‡)
1,2-Trans-Dichloroethene	21	not available	100	120 (RBC) N
Toluene	6	200,000	1000	200 (EMEG†)
Semi-Volatile Organic Compounds	**Maximum Detected Concentration (µg/L)**	**NJ Class SE-2 Surface Water Quality Standards (µg/L)**	**NJ Maximum Contaminant Levels (µg/L)**	**Environmental Comparison Value (µg/L)**
1,2-Dichlorobenzene	**2,740**	16,500	600	270 (RBC§) N
1,3-Dichlorobenzene	**2,920**	22,200	600	180 (RBC) N
1,4-Dichlorobenzene	**4,680**	3,159	75	0.47 (RBC) C
1,2,4-Trichlorobenzene	**82**	113	9	7.2 (RBC) N
2,4-Dimethylphenol	**1,000**	not available	not available	200 (RMEG)
Acenapthene	93	not available	not available	370 (RBC) N
2-Chlorophenol	3.9	402	not available	30 (RBC) N
Phenol	241	4,600,000	not available	3,000 (RMEG)
Fluorene	2.8	1,340	not available	240 (RBC) N
Naphthalene	**270**	not available	300	6.5 (RBC) N
Metals	**Maximum Detected Concentration (µg/L)**	**NJ Class SE-2 Surface Water Quality Standards (µg/L)**	**NJ Maximum Contaminant Levels (µg/L)**	**Environmental Comparison Value (µg/L)**
Arsenic	**10**	0.136	10	0.02 (CREG)
Chromium (Total)	**1,240,000**	3,230	100	not available
Copper	**173,000**	7.9	1,300	300 (EMEG)
Lead	**136,000**	210	15	not available
Mercury	**19,400**	0.146	2	not available
Nickel	**982,000**	3,900	no MCL monitoring req.	200 (RMEG)
Zinc	**487,000**	not available	5000	2,000 (EMEG)

* Cancer Risk Evaluation Guide for 1×10^{-6} excess cancer risk

† Environmental Media Evaluation Guide

‡ Reference Media Evaluation Guide

§ Risk Based Concentration (N: Non carcinogenic effects; C: Carcinogenic effects)

Contaminants of Concern are in boldface

Table 6
Standard Chlorine Chemical Company - Groundwater Contaminants
Data from Sampling Events Conducted between August 1983 - February 1999

Volatile Organic Compounds	Maximum Detected Concentration (µg/L)	NJ Groundwater Quality Standards (µg/L)	NJ Maximum Contaminant Levels (µg/L)	Environmental Comparison Value (µg/L)
Chlorobenzene	**93,000**	4	not available	200 (RMEG*)
1,2-Trans-Dichloroethene	**244**	100	100	120 (RBC†) N
1,1,2-Trichloroethane	**30**	not available	3	0.19 (RBC) C
Trichloroethylene	**13,960**	1	1	0.026 (RBC) C
Tetrachloroethylene	**5,350**	1	1	0.53 (RBC) C
Methylene chloride	**415**	2	3	4.1 (RBC) C
Ethylbenzene	310	0.7	700	1,000 (RMEG)
Vinyl chloride	**669**	5	2	0.015 (RBC) C
Xylenes	**1,550**	not available	1,000	210 (RBC) N
Toluene	**1,290**	1,000	1,000	200 (EMEG‡)
Semi-Volatile Organic Compounds	**Maximum Detected Concentration (µg/L)**	**NJ Groundwater Quality Standards (µg/L)**	**NJ Maximum Contaminant Levels (µg/L)**	**Environmental Comparison Value (µg/L)**
1,2-Dichlorobenzene	**33,000**	600	600	270 (RBC) N
1,3-Dichlorobenzene	**26,900**	600	600	180 (RBC) N
1,4-Dichlorobenzene	**33,000**	75	75	0.47 (RBC) C
1,2,4-Trichlorobenzene	**26,000**	900	9	7.2 (RBC) N
2,4-Dimethylphenol	**38,000**	100	not available	200 (RMEG)
Acenapthene	**4,300**	400	not available	370 (RBC) N
Acenaphthylene	**96**	10	not available	not available
2-Chlorophenol	**63**	40	not available	30 (RBC) N
Phenol	**360,000**	4,000	not available	3,000 (RMEG)
2-Methylphenol	**58,000**	not available	not available	1,800 (RBC) N
2,4-Dichlorophenol	**321**	20	not available	30 (EMEG)
4-Methylphenol	**200,000**	not available	not available	180 (RBC) N
Bis (2-Ethylhexyl) phthalate	**11,100**	30	6	3 (CREG§)
Fluorene	**303**	300	not available	240 (RBC) N
Phenanthrene	**216**	10	not available	not available
Anthracene	69	2,000	not available	1,800 (RBC) N
Naphthalene	**58,200**	not available	300	6.5 (RBC) N
Metals	**Maximum Detected Concentration (µg/L)**	**NJ Groundwater Quality Standards (µg/L)**	**NJ Maximum Contaminant Levels (µg/L)**	**Environmental Comparison Value (µg/L)**
Arsenic	**130**	0.02	10	0.02 (CREG)
Antimony	**390**	2	6	4 (RMEG)
Chromium (Total)	**101,700**	100	100	not available
Chromium (Hexavalent)	**97,000**	not available	not available	30 (RMEG)
Copper	**350**	1,000	1,300	300 (EMEG)
Cyanide	197	200	200	200 (RMEG)
Lead	**44,900**	5	15	not available
Mercury	**142**	2	2	not available
Nickel	**6,740**	100	no MCL monitoring req.	200 (RMEG)
Zinc	**11,900**	5,000	5,000	2,000 (EMEG)

* Reference Media Evaluation Guide
† Risk Based Concentration (N: Non carcinogenic effects; C: Carcinogenic effects)
‡ Environmental Media Evaluation Guide
§ Cancer Risk Evaluation Guide for 1×10^{-6} excess cancer risk
Contaminants of Concern are in boldface

Table 7

Standard Chlorine Chemical Company - Off Site Sediment Contaminants
Data from Sampling Events Conducted between January 1991 - October 2002

Volatile Organic Compounds	Maximum Detected Concentration (mg/kg)	Freshwater Sediment Screening Guidelines (mg/kg)	NJ Non-Residential Direct Contact Soil Cleanup Criteria (NRDCSCC) (mg/kg)	Environmental Comparison Value (mg/kg)
Benzene	0.41	0.34	13	52 (RBC*) C
Chlorobenzene	120	not available	680	800 (EMEG†)
Toluene	0.02	2.5	1,000	40 (EMEG)
Methylene Chloride	0.0087	not available	210	90 (CREG‡)
Xylenes	0.16	>0.12	1,000	400 (EMEG)
Ethylbenzene	0.73	1.40	1,000	5,000 (RMEG§)
Semi-Volatile Organic Compounds	**Maximum Detected Concentration (mg/kg)**	**Freshwater Sediment Screening Guidelines (mg/kg)**	**NJ Non-Residential Direct Contact Soil Cleanup Criteria (NRDCSCC) (mg/kg)**	**Environmental Comparison Value (mg/kg)**
1,2-Dichlorobenzene	280	0.035	10,000	5,000 (RMEG)
1,3-Dichlorobenzene	290	not available	10,000	31,000 (RBC) N
1,4-Dichlorobenzene	**360**	0.11	10,000	120 (RBC) C
1,2,4-Trichlorobenzene	**1,200**	not available	1,200	500 (RMEG)
Anthracene	21	0.22	10,000	20,000 (EMEG)
Acenapthene	7.1	0.02	10,000	1,000 (EMEG)
Benzo(a)anthracene	**26**	0.32	4	3.9 (RBC) C
Benzo(b)fluoranthene	**19**	0.24	4	3.9 (RBC) C
Benzo(a)pyrene	**17**	0.37	0.66	0.1 (CREG)
Benzo(g,h,i)perylene	**4.90**	0.17	not available	not available
Bis (2-Ethylhexyl) phthalate	15	not available	210	50 (CREG)
Chrysene	8	0.34	40	390 (RBC) C
Fluorene	4.2	0.19	10,000	800 (EMEG)
Fluoranthene	35	0.75	10,000	800 (EMEG)
Indeno(1,2,3-cd)pyrene	**56**	0.20	10,000	3.9 (RBC) C
Naphthalene	**4,570**	0.16	4,200	40 (EMEG)
Phenanthrene	**43**	0.56	not available	not available
Pyrene	46	0.49	10,000	2,000 (RMEG)
PCB - Arochlor 1254	**0.21**	0.005	2	0.06 (EMEG)
2,3,7,8-TCDD (Dioxin)	**0.0000964**	not available	not available	1.9×10^{-5} (RBC) C
Metals	**Maximum Detected Concentration (mg/kg)**	**Freshwater Sediment Screening Guidelines (mg/kg)**	**NJ Non-Residential Direct Contact Soil Cleanup Criteria (NRDCSCC) (mg/kg)**	**Environmental Comparison Value (mg/kg)**
Chromium (Total)	**11,700**	26	6,100**	not available
Chromium (Hexavalent)	73	not available	6,100	200 (RMEG)
Lead	**337**	31	600	not available
Arsenic	**105**	6	20	0.5 (CREG)
Copper	**295**	16	600	60 (EMEG)
Mercury	**0.650**	0.2	270	not available
Nickel	308	16	2,400	20,000 (RBC) N

* Risk Based Concentration (N: Non carcinogenic effects; C: Carcinogenic effects)
† Environmental Media Evaluation Guide
‡ Cancer Risk Evaluation Guide for 1×10^{-6} excess cancer risk
§ Reference Media Evaluation Guide
** Criterion based on the ingestion exposure pathway for hexavalent chromium
Contaminants of Concern are in boldface

Table 8

Standard Chlorine Chemical Company - Off-Site Surface Water Contaminants

Data from Sampling Events Conducted between August 1996 - October 2002

Volatile Organic Compounds	Maximum Detected Concentration (µg/L)	NJ Class SE-2 Surface Water Quality Standards (µg/L)	NJ Maximum Contaminant Levels (µg/L)	Environmental Comparison Value (µg/L)
Benzene	**23**	71	1	0.6 (CREG*)
Chlorobenzene	**760**	21,000	not available	200 (RMEG†)
Semi-Volatile Organic Compounds	**Maximum Detected Concentration (µg/L)**	**NJ Class SE-2 Surface Water Quality Standards (µg/L)**	**NJ Maximum Contaminant Levels (µg/L)**	**Environmental Comparison Value (µg/L)**
1,2-Dichlorobenzene	**6,130**	16,500	600	270 (RBC§) N
1,3-Dichlorobenzene	**430**	22,200	600	180 (RBC) N
1,4-Dichlorobenzene	**6,370**	3,159	75	0.47 (RBC) C
1,2,4-Trichlorobenzene	**200**	113	9	7.2 (RBC) N
Naphthalene	**45**	NA	300	6.5 (RBC) N
Metals	**Maximum Detected Concentration (µg/L)**	**NJ Class SE-2 Surface Water Quality Standards (µg/L)**	**NJ Maximum Contaminant Levels (µg/L)**	**Environmental Comparison Value (µg/L)**
Chromium (Total)	**3,000**	3,230	100	not available

* Cancer Risk Evaluation Guide for 1×10^{-6} excess cancer risk

† Reference Media Evaluation Guide

§ Risk Based Concentration (N: Non carcinogenic effects; C: Carcinogenic effects)

Contaminants of Concern are in boldface

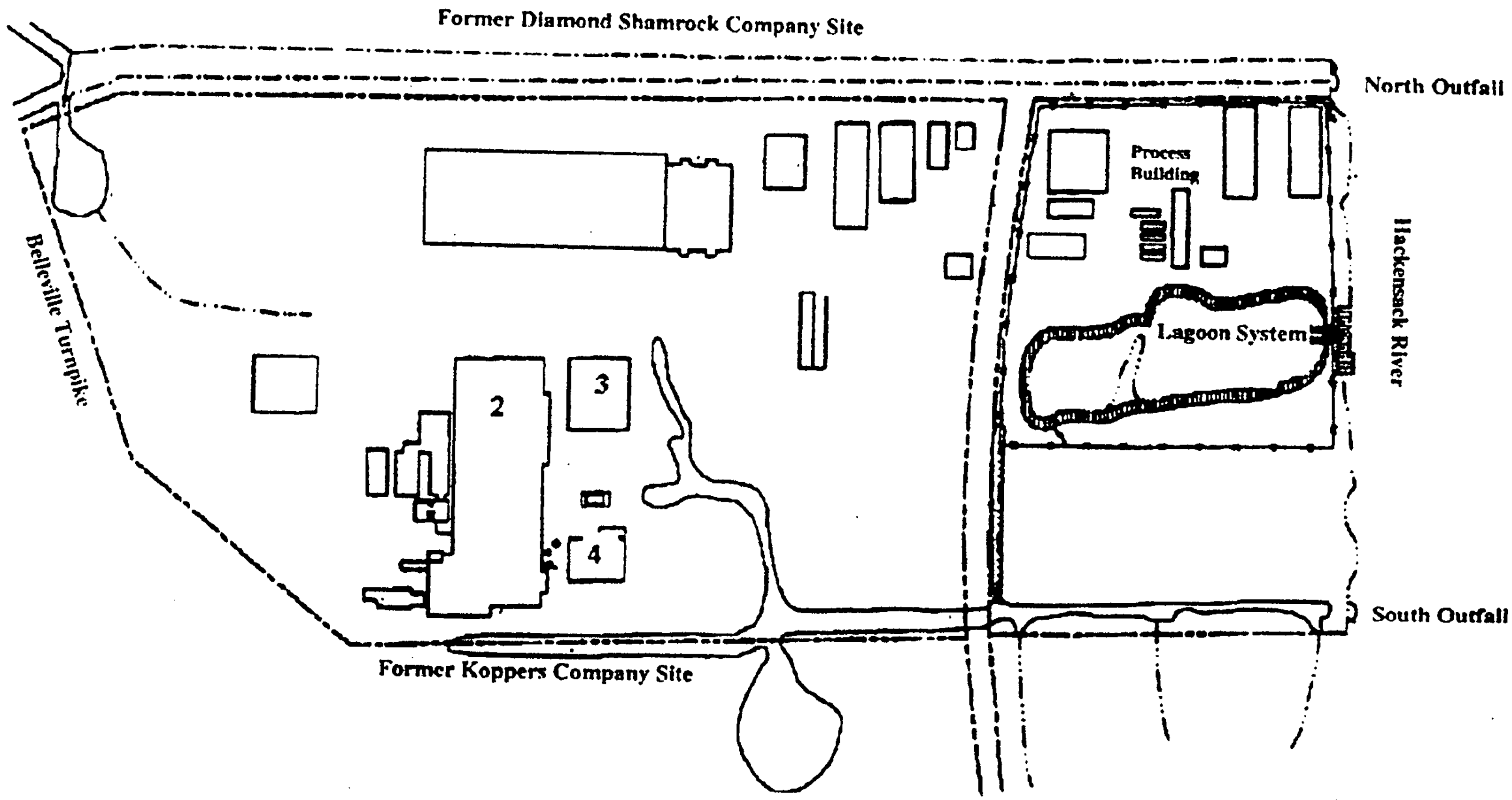
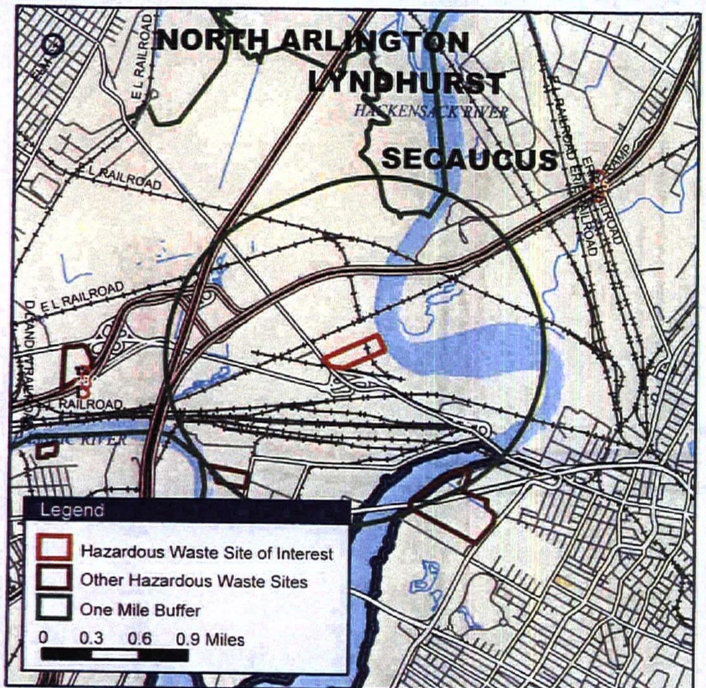


Figure 2: Site Map of the Standard Chlorine Chemical Company

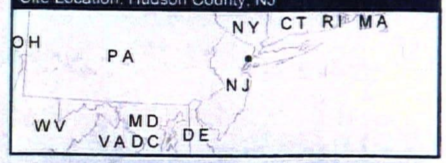
Standard Chlorine
Kearny, NJ
EPA Facility ID: NJD002175057

ATSDR CDC
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY



Base Map Source: Geographic Data Technology (DYNAMAP 2000), August 2002
Site Boundary Data Source: ATSDR Public Health GIS Program, August 2002
Coordinate System (All Panels): NAD 1983 StatePlane New Jersey FIPS 2900 Feet

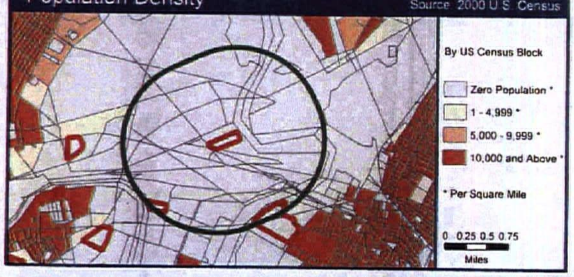
Site Location: Hudson County, NJ



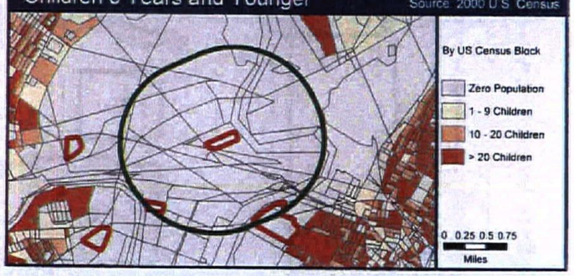
Demographic Statistics Within One Mile of Site*	
Total Population	0
White Alone	0
Black Alone	0
Am. Indian & Alaska Native Alone	0
Asian Alone	0
Native Hawaiian & Other Pacific Islander Alone	0
Some Other Race Alone	0
Two or More Races	0
Hispanic or Latino**	0
Children Aged 6 and Younger	0
Adults Agend 65 and Older	0
Females Aged 15 to 44	0
Total Housing Units	0

Demographics Statistics Source: 2000 U.S. Census
* Calculated using an area-proportion spatial analysis technique
** People who identify their origin as Hispanic or Latino may be of any race.

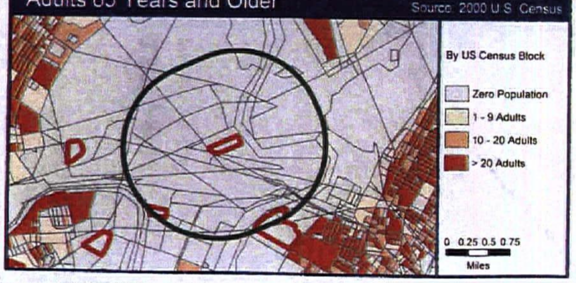
Population Density — Source: 2000 U.S. Census



Children 6 Years and Younger — Source: 2000 U.S. Census



Adults 65 Years and Older — Source: 2000 U.S. Census



Females Aged 15 to 44 — Source: 2000 U.S. Census

GENERATED: 12-04-2003

CDC
FOR INTERNAL AND EXTERNAL RELEASE
CENTERS FOR DISEASE CONTROL AND PREVENTION | UNITED STATES DEPARTMENT OF HEALTH AND HUMAN SERVICES

Figure 3: Demographic Information of the Standard Chlorine Site based on 2000 U.S. Census

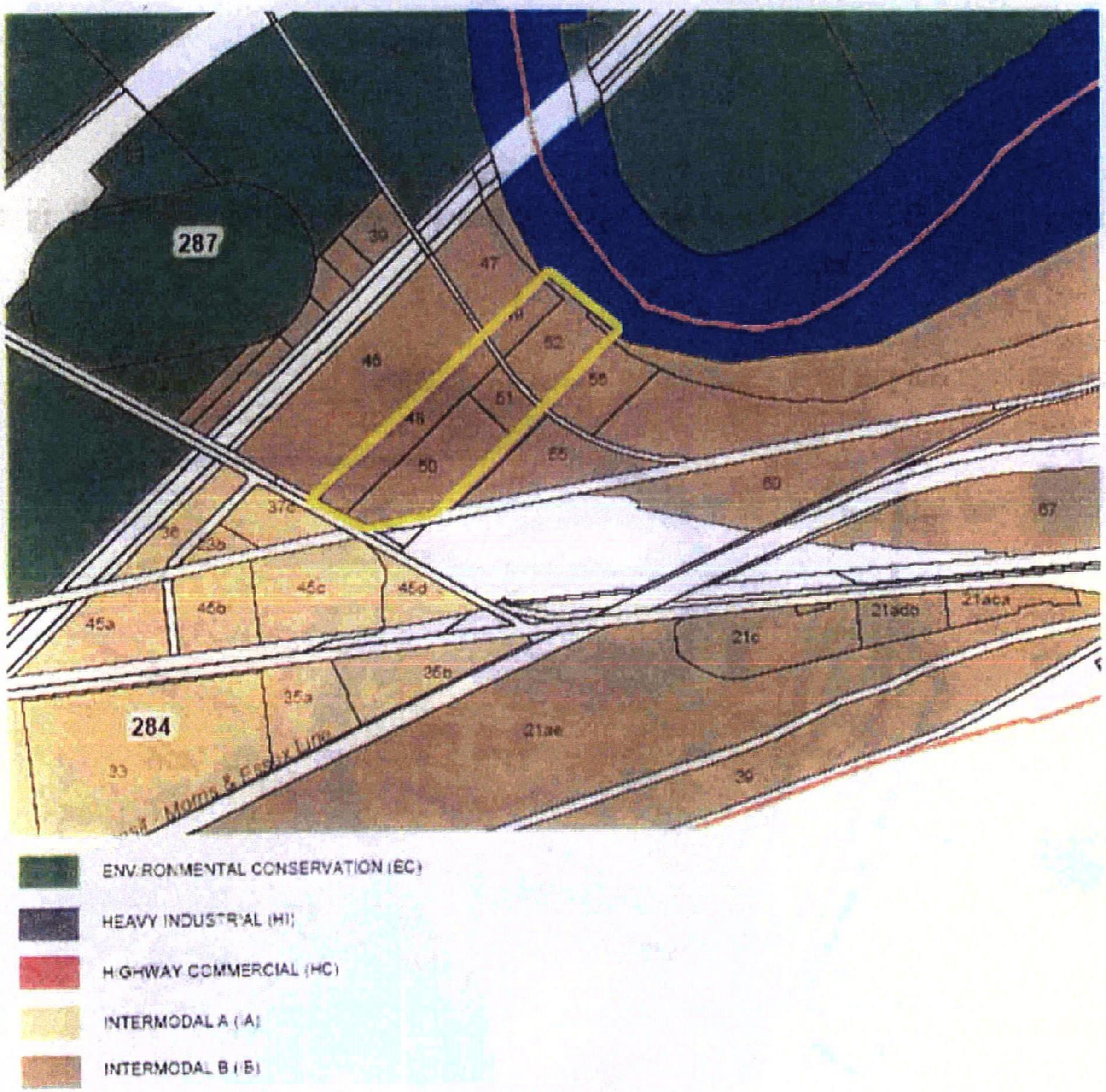


Figure 4: The New Jersey Meadowlands Commission zoning map (yellow represents site boundaries)

Available from: http://www.meadowlands.state.nj.us/maps/zone_2004_32X43.pdf

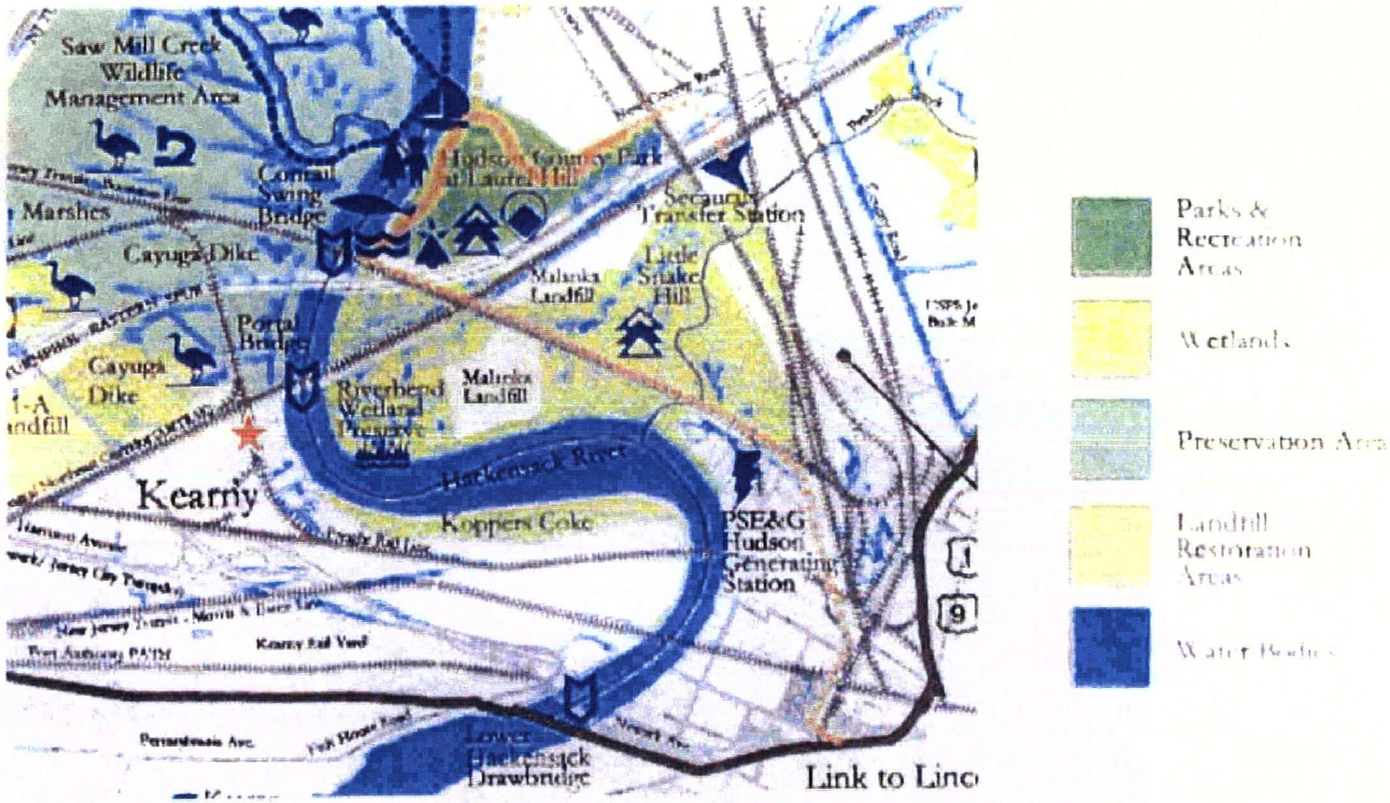


Figure 5: Map showing recreational and conservation areas near the Standard Chlorine site (star represents the site location)

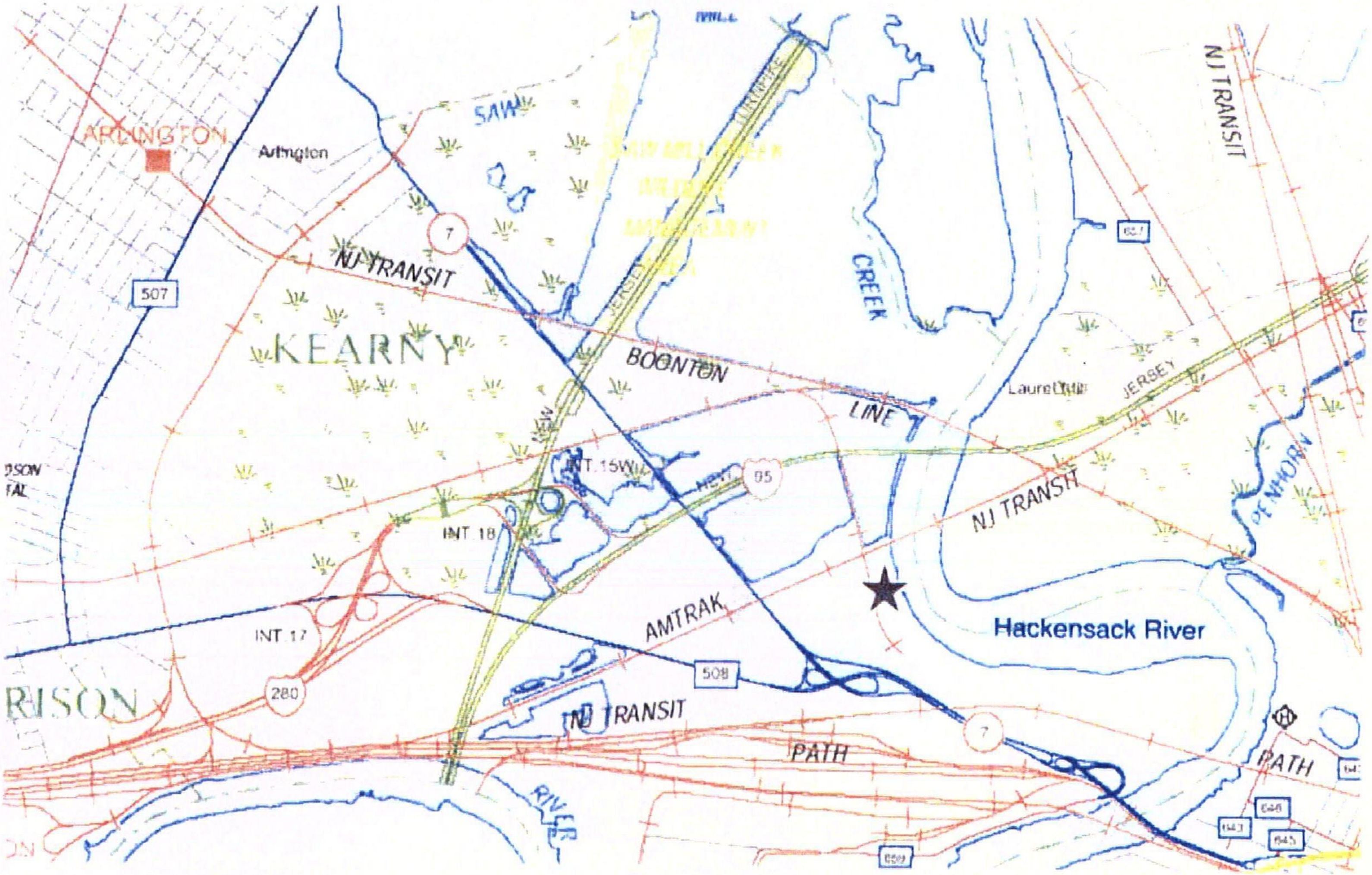


Figure 6: Map depicting the major roadways/railway transit lines near the Standard Chlorine site (star represents the site location)

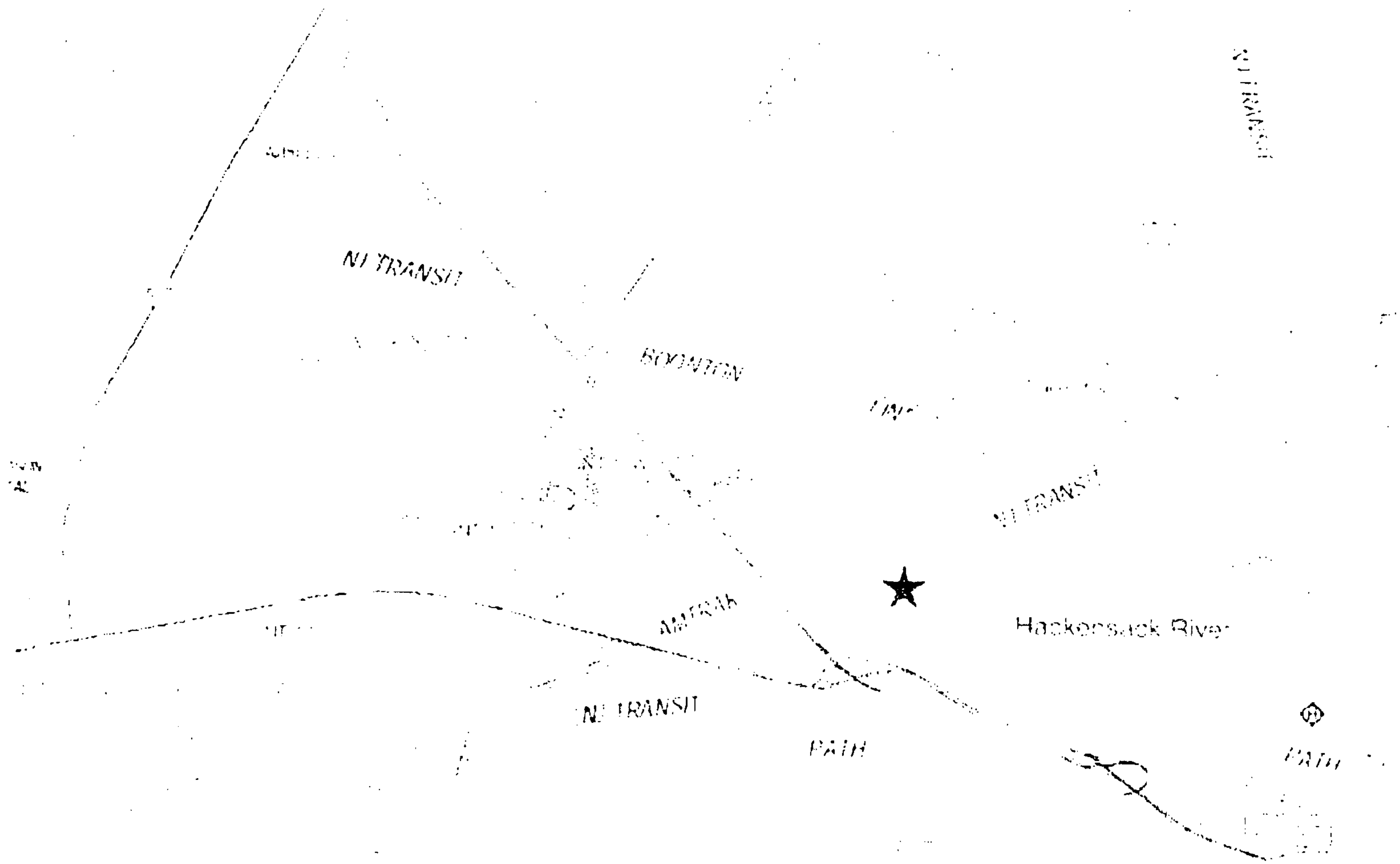
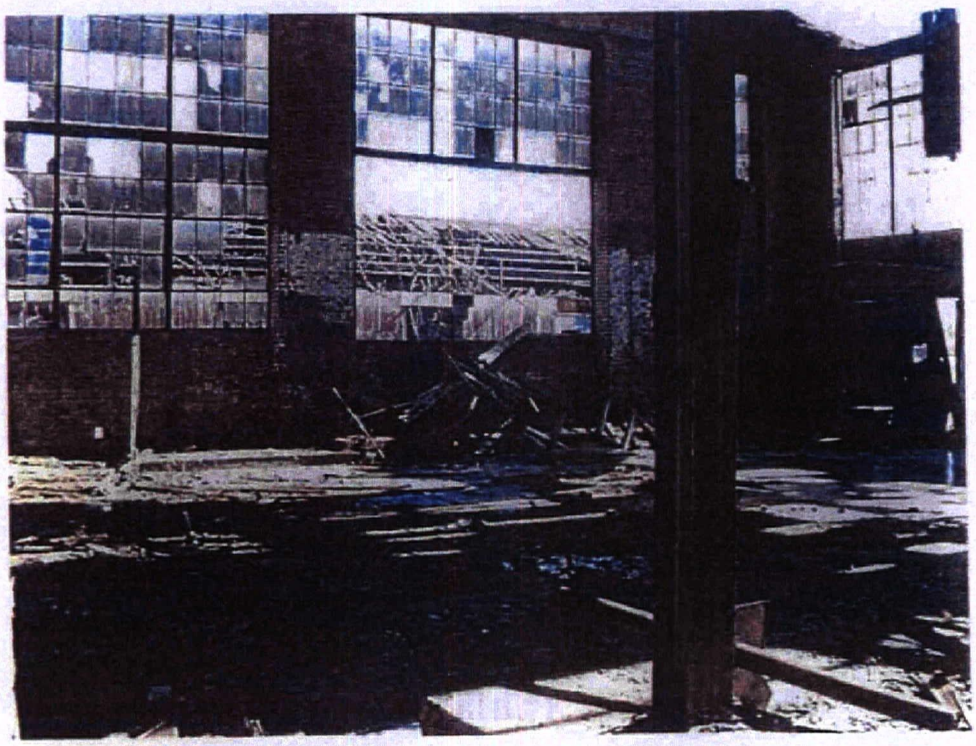
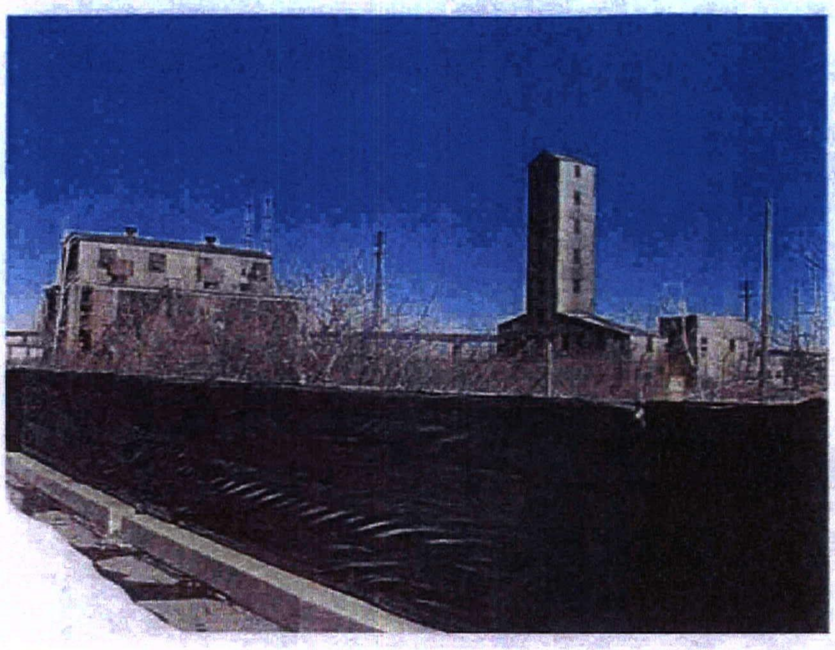


Figure 6: Map depicting the major roadways/railway transit lines near the Standard Chlorine site (star represents the site location)

Photograph 1: Broken bricks and glass on the Standard Chlorine site



Photograph 2: Example of dilapidated building on the Standard Chlorine site

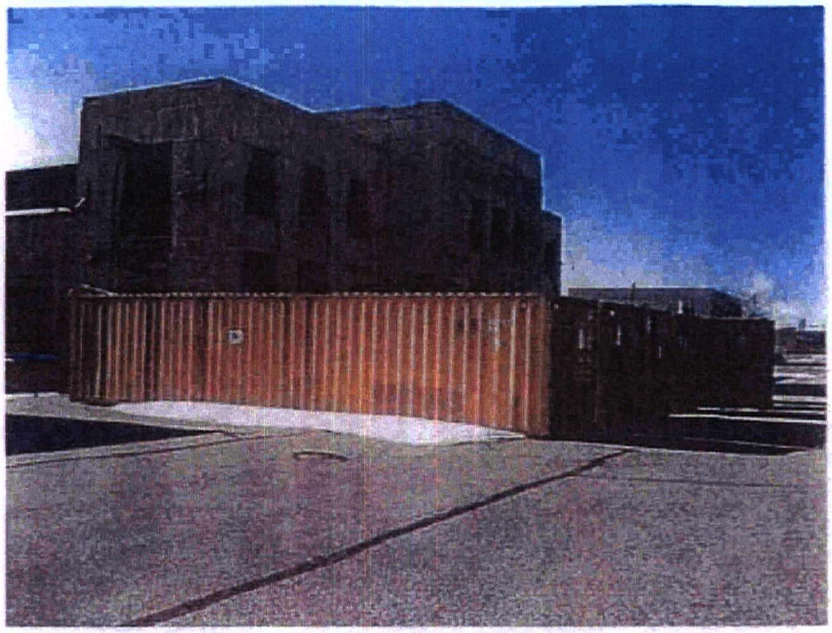


Photograph 3: The former distillation building in the lagoon system area

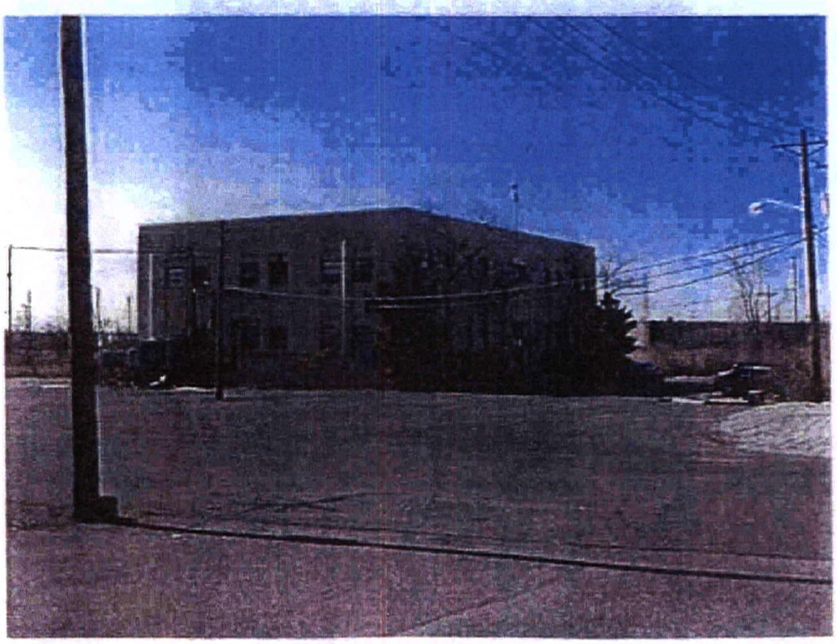
Photograph 4: The lagoon system

Photograph 5: Trench with standing water located inside the fenced area surrounding the lagoon system

Photograph 6: The southern drainage ditch

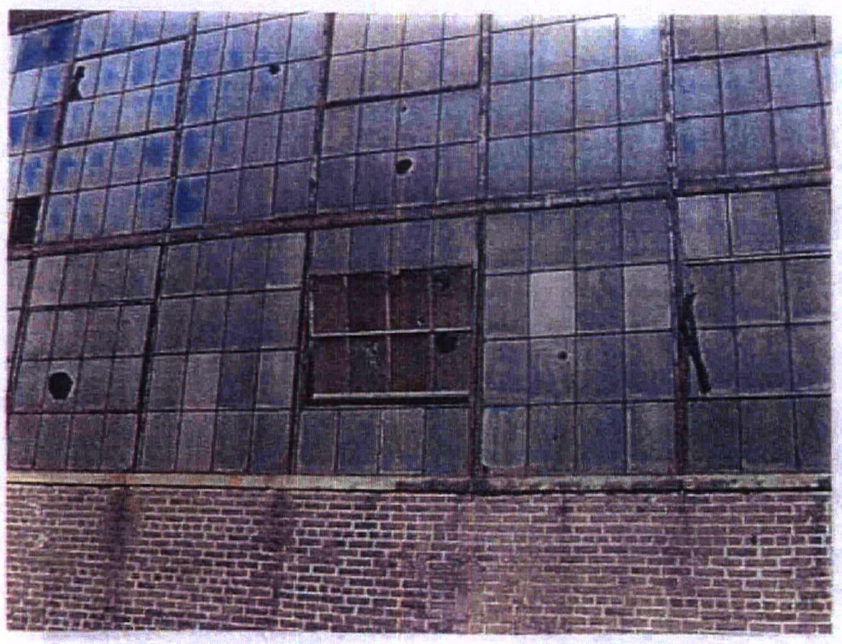


Photograph 7: Sea boxes containing dioxin-contaminated asbestos among other process wastes



Photograph 8: The office building on the western portion of the Standard Chlorine site

Photograph 9: Entrance to the Standard Chlorine site



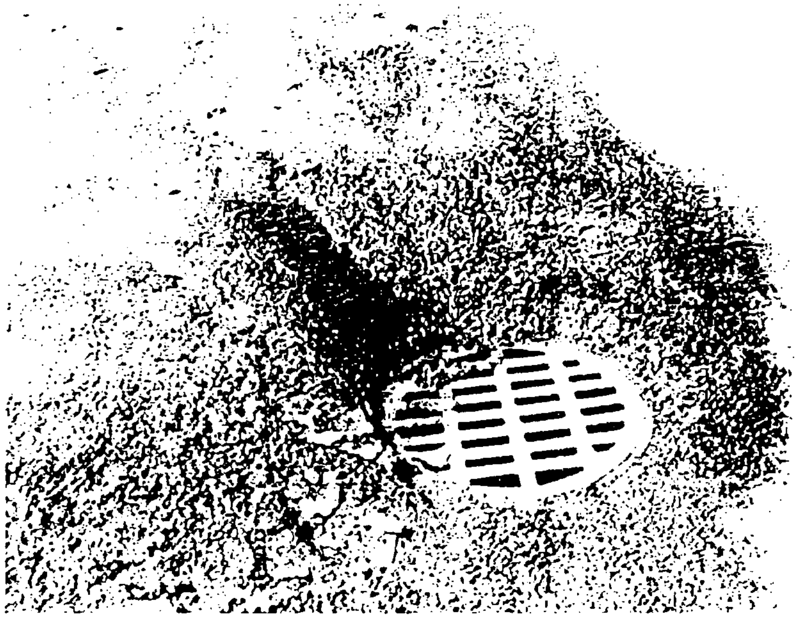
Photograph 10: Example of broken windows on the Standard Chlorine site

Photograph 11: The north outfall adjacent to the former Diamond Shamrock site

Photograph 12: Trailer storage on the former Diamond Shamrock property

Photograph 13: Storm drain located on the driveway shared between Standard Chlorine and the former Diamond Shamrock site

Photograph 14: Standing water as observed in the shared driveway



Photograph 13: Storm drain located on the driveway shared between Standard Chlorine and the former Diamond Shamrock site

Photograph 14: Standing water as observed in the shared driveway

APPENDIX C

1,2-Dichlorobenzene

1,2-Dichlorobenzene is a colorless to pale yellow liquid with a pleasant odor. It is used as a fumigant, solvent, chemical intermediate, and insecticide.

1,2-Dichlorobenzene can affect you when breathed in and by passing through your skin. Contact can irritate and burn the skin and eyes. Skin allergy may develop. Exposure can cause headache, nausea, and irritation of the nose and throat. Higher exposure can cause you to become dizzy and lightheaded and to pass out. Long-term exposure may damage the blood cells. 1,2-Dichlorobenzene may damage the liver, kidneys and lungs, and affect the nervous system. This chemical has not been adequately evaluated to determine whether brain or other nerve damage could occur with repeated exposure. However, many solvents and other petroleum-based chemicals have been shown to cause such damage. Effects may include reduced memory and concentration, personality changes (withdrawal, irritability), fatigue, sleep disturbances, reduced coordination, and/or effects on nerves supplying internal organs (autonomic nerves) and/or nerves to the arms and legs (weakness, "pins and needles").

There is a suggested association between exposure to 1,2-Dichlorobenzene and leukemia. According to the information presently available to the New Jersey Department of Health and Senior Services, 1,2-Dichlorobenzene has been tested and has not been shown to affect reproduction.

1,3-Dichlorobenzene

1,3-Dichlorobenzene is a colorless liquid. It is used as a fumigant, an insecticide, and as a chemical intermediate. Acute (short-term) health effects may occur immediately or shortly after exposure to 1,3-Dichlorobenzene. Breathing 1,3-Dichlorobenzene can irritate the nose and throat causing coughing and wheezing. Contact can cause skin and eye irritation and burns. Exposure to 1,3-Dichlorobenzene can cause headache, drowsiness, nausea, vomiting diarrhea and abdominal cramps. 1,3-Dichlorobenzene may damage the red blood cells leading to low blood count (anemia). Chronic (long-term) health effects can occur at some time after exposure to 1,3-Dichlorobenzene and can last for months or years. There is no evidence that 1,3-Dichlorobenzene causes cancer in animals. This is based on test results presently available to the New Jersey Department of Health and Senior Services from published studies. According to the information presently available to the New Jersey Department of Health and Senior Services, 1,3-Dichlorobenzene has not been tested for its ability to affect reproduction. Other chronic effects include skin allergies. If an allergy develops, very low future exposure can cause itching and a skin rash. 1,3-Dichlorobenzene may affect the liver and kidneys.

1,4-Dichlorobenzene

1,4-Dichlorobenzene is a chemical used to control moths, molds, and mildew, and to deodorize restrooms and waste containers. It is also called para-DCB or p-DCB. Other

Toxicological Characteristics of Chemicals of Concern

The toxicological summaries provided below are based on ATSDR's ToxFAQs (http://www.atsdr.cdc.gov/toxfaq.html) and the NJDHSS Right to Know Program (http://www.state.nj.us/health/eoh/rtkweb/rtkhsfs.htm#D). Health effects are summarized in this section for some of the chemicals of concern found most frequently above CVs in the Hackensack River surface water and sediment.

The health effects described in the toxicological summaries are typically known to occur at levels of exposure much higher than those that occur from environmental contamination. The chance that a health effect will occur is dependent on the amount, frequency and duration of exposure, and the individual susceptibility of exposed persons.

Chromium

Chromium is a naturally occurring element found in rocks, animals, plants, soil, and in volcanic dust and gases. Chromium is present in the environment in several different forms, which are chromium(0), chromium(III), and chromium(VI). No taste or odor is associated with chromium compounds. The metal chromium, which is the chromium(0) form, is used for making steel. Chromium(VI) and chromium(III) are used for chrome plating, dyes and pigments, leather tanning, and wood preserving.

Chromium enters the air, water, and soil mostly in the chromium(III) and chromium(VI) forms. In air, chromium compounds are present mostly as fine dust particles which eventually settle over land and water. Chromium can strongly attach to soil and only a small amount can dissolve in water and move deeper in the soil to underground water. Fish do not accumulate much chromium in their bodies from water.

Breathing high levels of chromium(VI) can cause irritation to the nose, such as runny nose, nosebleeds, and ulcers and holes in the nasal septum. Ingesting large amounts of chromium(VI) can cause stomach upsets and ulcers, convulsions, kidney and liver damage, and even death. Skin contact with certain chromium(VI) compounds can cause skin ulcers. Allergic reactions consisting of severe redness and swelling of the skin have been noted.

Several studies have shown that chromium(VI) compounds can increase the risk of lung cancer. Animal studies have also shown an increased risk of cancer. The World Health Organization (WHO) has determined that chromium(VI) is a human carcinogen. The US Department of Health and Human Services (DHHS) has determined that certain chromium(VI) compounds are known to cause cancer in humans. The EPA has determined that chromium(VI) in air is a human carcinogen.

It is unknown if exposure to chromium will result in birth defects or other developmental effects in people. Birth defects have been observed in animals exposed to chromium(VI). It is likely that health effects seen in children exposed to high amounts of chromium will be similar to the effects seen in adults.

names include Paramoth, Para crystals, and Paracide reflecting its widespread use to kill moths. At room temperature, p-DCB is a white solid with a strong, pungent odor. When exposed to air, it slowly changes from a solid to a vapor. Most p-DCB in our environment comes from its use in moth repellent products and in toilet deodorizer blocks.

In air, it breaks down to harmless products in about a month. It does not dissolve easily in water. It is not easily broken down by soil organisms. It evaporates easily from water and soil, so most is found in the air. It is taken up and retained by plants and fish.

There is no evidence that moderate use of common household products that contain p-DCB will result in harmful effects to your health. Harmful effects, however, may occur from high exposures. Very high usage of p-DCB products in the home can result in dizziness, headaches, and liver problems. Some of the patients who developed these symptoms had been using the products for months or even years after they first began to feel ill.

Workers breathing high levels of p-DCB (1,000 times more than levels in deodorized rooms) have reported painful irritation of the nose and eyes. There are cases of people who have eaten p-DCB products regularly for months to years because of its sweet taste. These people had skin blotches and lower numbers of red blood cells.

The US Department of Health and Human Services (DHHS) has determined that p-DCB may reasonably be anticipated to be a carcinogen. There is no direct evidence that p-DCB can cause cancer in humans. However, animals given very high levels in water developed liver and kidney tumors.

There is very little information on how children react to p-DCB exposure, but children would probably show the same effects as adults. No studies in people or animals show that p-DCB crosses the placenta or can be found in fetal tissues. Based on other similar chemicals, it is possible that this could occur. There is no credible evidence that p-DCB causes birth defects. One study found dichlorobenzenes in breast milk, but p-DCB has not been specifically measured.

<u>1,2,4-Trichlorobenzene</u>

1,2,4-Trichlorobenzene is a colorless liquid with a pleasant odor. It is used in heat transfer fluids, as a dielectric fluid, and in making chemicals, insecticides and fungicides. Breathing 1,2,4-Trichlorobenzene can irritate the nose, throat and eyes. Acute (short-term) health effects may occur immediately or shortly after exposure to 1,2,4-Trichlorobenzene: Contact can irritate the skin. Prolonged contact may cause skin burns. Chronic (long-term) health effects can occur at some time after exposure to 1,2,4-Trichlorobenzene and can last for months or years. Repeated exposure may damage the liver and kidneys. According to the information presently available to the New Jersey Department of Health and Senior Services, 1,2,4-Trichlorobenzene has been tested and has not been shown to cause cancer in animals. 1,2,4-Trichlorobenzene has been tested and has not been shown to affect reproduction based on information presently available to the New Jersey Department of Health and Senior Services.

Polycyclic Aromatic Hydrocarbons (PAHs)

Polycyclic aromatic hydrocarbons (PAHs) are a group of over 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat. PAHs are usually found as a mixture containing two or more of these compounds, such as soot. These include benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, benzo(g,h,i)perylene, indeno(1,2,3-cd0pyrene, phenanthrene, and naphthalene

Some PAHs are manufactured. These pure PAHs usually exist as colorless, white, or pale yellow-green solids. PAHs are found in coal tar, crude oil, creosote, and roofing tar, but a few are used in medicines or to make dyes, plastics, and pesticides.

Mice that were fed high levels of one PAH during pregnancy had difficulty reproducing and so did their offspring. These offspring also had higher rates of birth defects and lower body weights. It is not known whether these effects occur in people. Animal studies have also shown that PAHs can cause harmful effects on the skin, body fluids, and ability to fight disease after both short- and long-term exposure. But these effects have not been seen in people.

The US Department of Health and Human Services (DHHS) has determined that some PAHs may reasonably be expected to be carcinogens. Some people who have breathed or touched mixtures of PAHs and other chemicals for long periods of time have developed cancer. Some PAHs have caused cancer in laboratory animals when they breathed air containing them (lung cancer), ingested them in food (stomach cancer), or had them applied to their skin (skin cancer).

2,3,7,8-TCDD (Dioxin)

2,3,7,8-TCDD belongs to a family of 75 chemically related compounds commonly known as chlorinated dioxins (CDD). It is one of the most toxic of the CDDs and is the one most studied. 2,3,7,8-TCDD is odorless and the odors of the other CDDs are not known.

2,3,7,8-TCDD may be formed during the chlorine bleaching process at pulp and paper mills. CDDs are also formed during chlorination by waste and drinking water treatment plants. They can occur as contaminants in the manufacture of certain organic chemicals. CDDs are released into the air in emissions from municipal solid waste and industrial incinerators.

When released into the air, some CDDs may be transported long distances, even around the globe. CDD concentrations may build up in the food chain, resulting in measurable levels in animals. Eating food, primarily meat, dairy products, and fish, makes up more than 90% of the intake of CDDs for the general population.

The most noted health effect in people exposed to large amounts of 2,3,7,8-TCDD is chloracne. Chloracne is a severe skin disease with acne-like lesions that occur mainly on the face and upper body. Other skin effects noted in people exposed to high doses of 2,3,7,8-TCDD include skin rashes, discoloration, and excessive body hair. Changes in blood and urine that may indicate liver damage also are seen in people.

In certain animal species, 2,3,7,8-TCDD is especially harmful and can cause death after a single exposure. In many species of animals, 2,3,7,8-TCDD weakens the immune system and causes a decrease in the system's ability to fight bacteria and viruses. In other animal studies, exposure to 2,3,7,8-TCDD has caused reproductive damage and birth defects. The offspring of animals exposed to 2,3,7,8-TCDD during pregnancy often had severe birth defects including skeletal deformities, kidney defects, and weakened immune responses.

Several studies suggest that exposure to 2,3,7,8-TCDD increases the risk of several types of cancer in people. Animal studies have also shown an increased risk of cancer from exposure to 2,3,7,8-TCDD. The World Health Organization (WHO) has determined that 2,3,7,8-TCDD is a human carcinogen. The US Department of Health and Human Services (DHHS) has determined that 2,3,7,8-TCDD may reasonably be anticipated to cause cancer. Very few studies have looked at the effects of CDDs on children. Chloracne has been seen in children exposed to high levels of CDDs. It is not known that CDDs affect the ability of people to have children or if it causes birth defects, but given the effects observed in animal studies, this cannot be ruled out.

PCB – Arochlor 1260

Polychlorinated biphenyls (PCBs) are mixtures of up to 209 individual chlorinated compounds (known as congeners). There are no known natural sources of PCBs. PCBs are either oily liquids or solids that are colorless to light yellow. PCBs have no known smell or taste. Many commercial PCB mixtures are known in the US by the trade name Arochlor. PCBs have been used as coolants and lubricants in transformers, capacitors, and other electrical equipment because they don't burn easily and are good insulators.

PCBs do not readily break down in the environment and thus may remain there for very long periods of time. PCBs can travel long distances in the air and be deposited in areas far away from where they were released. PCBs are taken up by small organisms and fish in water. They are also taken up by other animals that eat these aquatic animals as food. PCBs accumulate in fish and marine mammals, reaching levels that may be many thousands of times higher than in water.

The most commonly observed health effects in people exposed to large amounts of PCBs are skin conditions such as acne and rashes. Studies in exposed workers have shown changes in blood and urine that may indicate liver damage. PCB exposures in the general population are not likely to result in skin and liver effects. Most of the studies of health effects of PCBs in the general population examined children of mothers who were exposed to PCBs. Animals that ate food containing large amounts of PCBs for short periods of time had mild liver damage and some died. Animals that ate smaller amounts of PCBs in food over several weeks or months developed various kinds of health effects, including anemia; acne-like skin conditions; and liver, stomach, and thyroid gland injuries. Other effects of PCBs in animals include changes in the immune system, behavioral alterations, and impaired reproduction. PCBs are not known to cause birth defects.

Few studies of workers indicate that PCBs were associated with certain kinds of cancer in humans, such as cancer of the liver and biliary tract. Rats that ate food containing high levels of PCBs for two years developed liver cancer. The US Department of Health and Human Services (DHHS) has concluded that PCBs may reasonably be anticipated to be carcinogens. The USEPA and the International Agency for Research on Cancer (IARC) have determined that PCBs are probably carcinogenic to humans.

Women who were exposed to relatively high levels of PCBs in the workplace or ate large amounts of fish contaminated with PCBs had babies that weighed slightly less than babies from women who did not have these exposures. Babies born to women who ate PCB-contaminated fish also showed abnormal responses in tests of infant behavior. Some of these behaviors, such as problems with motor skills and a decrease in short-term memory, lasted for several years. Other studies suggest that the immune system was affected in children born to and nursed by mothers exposed to increased levels of PCBs. There are no reports of structural birth defects caused by exposure to PCBs or of health effects of PCBs in older children. The most likely way infants will be exposed to PCBs is from breast milk. Transplacental transfers of PCBs were also reported. In most cases, the benefits of breast-feeding outweigh any risks from exposure to PCBs in mother's milk.

APPENDIX D

Summary of Public Comments and Responses
Standard Chlorine Chemical Company, Inc. Public Health Assessment

This summary presents the comments received from interested parties on the Public Comment Draft of the Standard Chlorine Chemical Company, Inc. Public Health Assessment, and the subsequent responses of the NJDHSS and the ATSDR. The public comment period occurred from September 30 through November 13, 2004. Comments are grouped by Commenter, without personal identifiers. Note that page numbers in the comments and responses refer to the Public Comment Draft of the Public Health Assessment.

We are grateful to the two interested parties who provided their review and input on the draft Public Health Assessment. Where appropriate, the report was amended to address their comments and concerns.

Commenter A

Comment 1: *"Specifically, our disagreement arises as follows: "Indeterminate Public Health Hazard" for the biota pathway ... we feel that there is sufficient evidence to consider the site a "Public Health Hazard" for the Biota Pathway."*

Response 1: Although this site is a contributor to dioxin contamination of the Hackensack River, other regional sources have contributed to the dioxin contamination of the Newark Bay Complex, which includes the Hackensack River. As such, a reliable assessment of a particular site's contribution of contamination is difficult. Additional contaminant data for the Hackensack River relating to dioxin and other chlorinated organics are expected to be available shortly from the NJDEP. This information may provide an approximate estimate of the Standard Chlorine site's contribution of dioxin contamination to biota.

Comment 2: "*"No Apparent Public Health Hazard" for all other pathways: The pathway for air exposure was ruled out based on the fact that there is no residential population within 1 mile of the site ... we ask that the potential public health hazard from the air pathway be re-evaluated.*"

Response 2: We further discussed this comment with the NJDEP and a statement recommending air monitoring to evaluate impacts from site-related contaminants has been added as a separate recommendation to the final Public Health Assessment.

At the present time no residential population exists within a one-mile radius of the site, although there are residential communities beyond the one-mile radius. However, the NJDHSS agrees that the potential exists for future exposures to occur based upon planned area redevelopment. As such, the pathway classification for ambient air has been changed from eliminated to potential; the Public Health Hazard Category recommended for this pathway is ***"Indeterminate Public Health Hazard"***.

Comment 3: "*Technical details: - Tables 2, 4, and 5 each indicate a concentration that exceeds 1,000,000 mg/kg for an individual pollutant. This is not possible.*"

Response 3: The NJDHSS acknowledges the above statement. The draft Public Health Assessment provided the analytical results as reported in the Remedial Investigation (Weston 1993).

Commenter B

Comment 1a: "*The Assessment is woefully inadequate and potentially misleading without additional data collection and information on how data was compiled and averaged ...*"

Response 1a: For the purpose of the draft Public Health Assessment, the NJDHSS obtained, organized, reviewed and evaluated environmental sampling data available from the responsible state and federal environmental agencies. A detailed explanation of this effort is provided in the Environmental Contamination section located on page 9 of the draft Public Health Assessment. Additionally, there are eight data tables provided in the report (Appendix A) which provide a chronological, media-specific description of both on- and off-site contamination.

Comment 1b: "*... dispersion modeling of volatile contaminants ... is necessary to determine the full extent of possible human exposure.*"

Response 1b: Currently, there are no individuals residing within a one-mile radius of the site, and air dispersion modeling was not conducted as part of the draft Public Health Assessment. On page 22 of the draft Public Health Assessment, the NJDHSS recommended that air monitoring data be collected during site remedial activities to determine the potential health impact of airborne contaminants to on- and off-site worker populations. Future air data, when available, will be evaluated in a separate Health Consultation. Additionally, a recommendation regarding air monitoring to evaluate impacts from site-related contaminants has been added to the final Public Health Assessment.

Comment 1c: "*... the south drainage ditch contains a brownish-white substance that should be characterized. An analysis of its fate and transport needs to be conducted.*"

Response 1c: Migration pathways from on- to off-site areas are discussed beginning on page 17 of the draft Public Health Assessment. This section includes an extensive description of the south drainage ditch and fate/transport to the Hackensack River.

Comment 1d: "*... the report does not contain any hydrological studies which evaluate groundwater and surface water movement associated with the site.*"

Response 1d: Please refer to Recommendation 2 located on page 22 of the draft Public Health Assessment. The NJDHSS concurs that hydrogeological studies are needed to characterize the direction and extent of contaminant migration from the site to off-site areas.

Comment 2: "*The Assessment fails to properly address the community health concerns.*"

Response 2: Please refer to the "Community Concerns" section located on page 8 of the draft Public Health Assessment. According to the local health department, USEPA, and NJDEP, no community concerns were reported for the site. The NJDHSS also searched and reviewed local news articles in an effort to identify community concerns. The focus of the majority of the articles was on remedial measures and the controversy over the possible addition of the site to the National Priorities List.

Prior to the submission of the draft Public Health Assessment for public comment release, staff of the NJDHSS and ATSDR conducted a second site visit. Information obtained during this site visit, which expanded our knowledge of community health concerns and potential human exposure pathways, has been incorporated into the Site Visit section of the final Public Health Assessment.

Comment 3: "*The Assessment is incomplete in its analysis of recreational uses of the Hackensack River ...Finally, although there are only two fishing locations identified by the Assessment, there are a number of other popular fishing locations ...*"

Response 3: Although recreational use of the river may be year-long with large populations involved depending on the season of year, individual exposures from this pathway are not continuous and vary by personal activity. Please note that the biota pathway in the draft Public Health Assessment was identified as a significant exposure pathway associated with the site.

Comment 4: "*The Assessment's analysis of the pathway exposure for anglers is incomplete.*"

Response 4: Considerable effort has been made by a number of state agencies in determining potential health risks to New Jersey anglers. Beginning on page 17 of the draft Public Health Assessment, the NJDEP Routine Monitoring Program for Toxics in Fish was discussed. This Program includes an education and outreach effort by the NJDEP, the Department of Agriculture and the NJDHSS via public hearings. Questions and answers recorded at these hearings may be viewed at www.state.nj.us/dep/dsr/response-budget. Discussions with regional angler communities are planned by the NJDEP to present available education and outreach information and, more importantly, identify locations where fishing for consumption regularly takes place despite posted fish consumption advisories.

The most recent NJDEP angler survey conducted of the Newark Bay Complex occurred in 1995 and included questions on the preparation of fish and crabs for consumption. Results indicated that most recreational anglers who reported eating fish and crabs prepared their catch according to fish consumption advisories, although some anglers reported not adhering to guidelines when preparing fish and crabs for soups and sauces. Pilot projects, in conjunction with additional angler surveys, are being planned to identify effective means of communicating advisories, fishing bans, and health risks associated with fish and shellfish obtained from the Newark and Raritan Bays, and the Hackensack and Passaic Rivers (K. Kirk-Pflugh, NJDEP, personal communication, 2004).

The above information has been incorporated into the Public Health Actions Planned section of the final Public Health Assessment.

Comment 5: "*... the Assessment must address current and future pathways for exposure ...*"

Response 5: Please refer to Recommendations 3 and 4 on page 22 of the draft Public Health Assessment.

Comment 6: "*... migration of on-site contaminants to the Hackensack River must stop immediately.*"

Response 6: The NJDHSS has recommended that the USEPA reduce the migration of on-site contaminants to the Hackensack River (see Recommendation 1 on page 21 of the draft Public Health Assessment).

GLOSSARY

ATSDR Glossary of Terms

The Agency for Toxic Substances and Disease Registry (ATSDR) is a federal public health agency with headquarters in Atlanta, Georgia, and 10 regional offices in the United States. ATSDR's mission is to serve the public by using the best science, taking responsive public health actions, and providing trusted health information to prevent harmful exposures and diseases related to toxic substances. ATSDR is not a regulatory agency, unlike the U.S. Environmental Protection Agency (EPA), which is the federal agency that develops and enforces environmental laws to protect the environment and human health. This glossary defines words used by ATSDR in communications with the public. It is not a complete dictionary of environmental health terms. If you have questions or comments, call ATSDR's toll-free telephone number, 1-888-42-ATSDR (1-888-422-8737).

General Terms

Absorption
The process of taking in. For a person or an animal, absorption is the process of a substance getting into the body through the eyes, skin, stomach, intestines, or lungs.

Acute
Occurring over a short time [compare with chronic].

Acute exposure
Contact with a substance that occurs once or for only a short time (up to 14 days) [compare with intermediate duration exposure and chronic exposure].

Additive effect
A biologic response to exposure to multiple substances that equals the sum of responses of all the individual substances added together [compare with antagonistic effect and synergistic effect].

Adverse health effect
A change in body function or cell structure that might lead to disease or health problems

Aerobic
Requiring oxygen [compare with anaerobic].

Ambient
Surrounding (for example, ambient air).

Anaerobic
Requiring the absence of oxygen [compare with aerobic].

Analyte
A substance measured in the laboratory. A chemical for which a sample (such as water, air, or blood) is tested in a laboratory. For example, if the analyte is mercury, the laboratory test will determine the amount of mercury in the sample.

Analytic epidemiologic study
A study that evaluates the association between exposure to hazardous substances and disease by testing scientific hypotheses.

Antagonistic effect
A biologic response to exposure to multiple substances that is less than would be expected if the known effects of the individual substances were added together [compare with additive effect and synergistic effect].

Background level
An average or expected amount of a substance or radioactive material in a specific environment, or typical amounts of substances that occur naturally in an environment.

Biodegradation
Decomposition or breakdown of a substance through the action of microorganisms (such as bacteria or fungi) or other natural physical processes (such as sunlight).

Biologic indicators of exposure study
A study that uses (a) biomedical testing or (b) the measurement of a substance [an analyte], its metabolite, or another marker of exposure in human body fluids or tissues to confirm human exposure to a hazardous substance [also see exposure investigation].

Biologic monitoring
Measuring hazardous substances in biologic materials (such as blood, hair, urine, or breath) to determine whether exposure has occurred. A blood test for lead is an example of biologic monitoring.

Biologic uptake
The transfer of substances from the environment to plants, animals, and humans.

Biomedical testing
Testing of persons to find out whether a change in a body function might have occurred because of exposure to a hazardous substance.

Biota
Plants and animals in an environment. Some of these plants and animals might be sources of food, clothing, or medicines for people.

Body burden
The total amount of a substance in the body. Some substances build up in the body because they are stored in fat or bone or because they leave the body very slowly.

CAP [see Community Assistance Panel.]

Cancer
Any one of a group of diseases that occur when cells in the body become abnormal and grow or multiply out of control.

Cancer risk
A theoretical risk for getting cancer if exposed to a substance every day for 70 years (a lifetime exposure). The true risk might be lower.

Carcinogen
A substance that causes cancer.

Case study
A medical or epidemiologic evaluation of one person or a small group of people to gather information about specific health conditions and past exposures.

Case-control study
A study that compares exposures of people who have a disease or condition (cases) with people who do not have the disease or condition (controls). Exposures that are more common among the cases may be considered as possible risk factors for the disease.

CAS registry number
A unique number assigned to a substance or mixture by the American Chemical Society Abstracts Service.

Central nervous system
The part of the nervous system that consists of the brain and the spinal cord.

CERCLA [see Comprehensive Environmental Response, Compensation, and Liability Act of 1980]

Chronic
Occurring over a long time [compare with acute].

Chronic exposure
Contact with a substance that occurs over a long time (more than 1 year) [compare with acute exposure and intermediate duration exposure]

Cluster investigation
A review of an unusual number, real or perceived, of health events (for example, reports of cancer) grouped together in time and location. Cluster investigations are designed to confirm case reports; determine whether they represent an unusual disease occurrence; and, if possible, explore possible causes and contributing environmental factors.

Community Assistance Panel (CAP)
A group of people from a community and from health and environmental agencies who work with ATSDR to resolve issues and problems related to hazardous substances in the community. CAP members work with ATSDR to gather and review community health concerns, provide information on how people might have been or might now be exposed to hazardous substances, and inform ATSDR on ways to involve the community in its activities.

Comparison value (CV)
Calculated concentration of a substance in air, water, food, or soil that is unlikely to cause harmful (adverse) health effects in exposed people. The CV is used as a screening level during the public health assessment process. Substances found in amounts greater than their CVs might be selected for further evaluation in the public health assessment process.

Completed exposure pathway [see exposure pathway].

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)
CERCLA, also known as Superfund, is the federal law that concerns the removal or cleanup of hazardous substances in the environment and at hazardous waste sites. ATSDR, which was created by CERCLA, is responsible for assessing health issues and supporting public health activities related to hazardous waste sites or other environmental releases of hazardous substances. This law was later amended by the Superfund Amendments and Reauthorization Act (SARA).

Concentration
The amount of a substance present in a certain amount of soil, water, air, food, blood, hair, urine, breath, or any other media.

Contaminant
A substance that is either present in an environment where it does not belong or is present at levels that might cause harmful (adverse) health effects.

Delayed health effect
A disease or an injury that happens as a result of exposures that might have occurred in the past.

Dermal
Referring to the skin. For example, dermal absorption means passing through the skin.

Dermal contact
Contact with (touching) the skin [see route of exposure].

Descriptive epidemiology
The study of the amount and distribution of a disease in a specified population by person, place, and time.

Detection limit
The lowest concentration of a chemical that can reliably be distinguished from a zero concentration.

Disease prevention
Measures used to prevent a disease or reduce its severity.

Disease registry
A system of ongoing registration of all cases of a particular disease or health condition in a defined population.

DOD
United States Department of Defense.

DOE
United States Department of Energy.

Dose (for chemicals that are not radioactive)
The amount of a substance to which a person is exposed over some time period. Dose is a measurement of exposure. Dose is often expressed as milligram (amount) per kilogram (a measure of body weight) per day (a measure of time) when people eat or drink contaminated water, food, or soil. In general, the greater the dose, the greater the likelihood of an effect. An "exposure dose" is how much of a substance is encountered in the environment. An "absorbed dose" is the amount of a substance that actually got into the body through the eyes, skin, stomach, intestines, or lungs.

Dose (for radioactive chemicals)
The radiation dose is the amount of energy from radiation that is actually absorbed by the body. This is not the same as measurements of the amount of radiation in the environment.

Dose-response relationship
The relationship between the amount of exposure [dose] to a substance and the resulting changes in body function or health (response).

Environmental media
Soil, water, air, biota (plants and animals), or any other parts of the environment that can contain contaminants.

Environmental media and transport mechanism
Environmental media include water, air, soil, and biota (plants and animals). Transport mechanisms move contaminants from the source to points where human exposure can occur. The environmental media and transport mechanism is the second part of an exposure pathway.

EPA
United States Environmental Protection Agency.

Epidemiologic surveillance [see Public health surveillance].

Epidemiology
The study of the distribution and determinants of disease or health status in a population; the study of the occurrence and causes of health effects in humans.

Exposure
Contact with a substance by swallowing, breathing, or touching the skin or eyes. Exposure may be short-term [acute exposure], of intermediate duration, or long-term [chronic exposure].

Exposure assessment
The process of finding out how people come into contact with a hazardous substance, how often and for how long they are in contact with the substance, and how much of the substance they are in contact with.

Exposure-dose reconstruction
A method of estimating the amount of people's past exposure to hazardous substances. Computer and approximation methods are used when past information is limited, not available, or missing.

Exposure investigation
The collection and analysis of site-specific information and biologic tests (when appropriate) to determine whether people have been exposed to hazardous substances.

Exposure pathway
The route a substance takes from its source (where it began) to its end point (where it ends), and how people can come into contact with (or get exposed to) it. An exposure pathway has five parts: a source of contamination (such as an abandoned business); an environmental media and transport mechanism (such as movement through groundwater); a point of exposure (such as a private well); a route of exposure (eating, drinking, breathing, or touching), and a receptor population (people potentially or actually exposed). When all five parts are present, the exposure pathway is termed a completed exposure pathway.

Exposure registry
A system of ongoing followup of people who have had documented environmental exposures.

Feasibility study
A study by EPA to determine the best way to clean up environmental contamination. A number of factors are considered, including health risk, costs, and what methods will work well.

Geographic information system (GIS)
A mapping system that uses computers to collect, store, manipulate, analyze, and display data. For example, GIS can show the concentration of a contaminant within a community in relation to points of reference such as streets and homes.

Grand rounds
Training sessions for physicians and other health care providers about health topics.

Groundwater
Water beneath the earth's surface in the spaces between soil particles and between rock surfaces [compare with surface water].

Half-life ($t\frac{1}{2}$)
The time it takes for half the original amount of a substance to disappear. In the environment, the half-life is the time it takes for half the original amount of a substance to disappear when it is changed to another chemical by bacteria, fungi, sunlight, or other chemical processes. In the human body, the half-life is the time it takes for half the original amount of the substance to disappear, either by being changed to another substance or by leaving the body. In the case of radioactive material, the half life is the amount of time necessary for one half the initial number of radioactive atoms to change or transform into another atom (that is normally not radioactive). After two half lives, 25% of the original number of radioactive atoms remain.

Hazard
A source of potential harm from past, current, or future exposures.

Hazardous Substance Release and Health Effects Database (HazDat)
The scientific and administrative database system developed by ATSDR to manage data collection, retrieval, and analysis of site-specific information on hazardous substances, community health concerns, and public health activities.

Hazardous waste
Potentially harmful substances that have been released or discarded into the environment.

Health consultation
A review of available information or collection of new data to respond to a specific health question or request for information about a potential environmental hazard. Health consultations are focused on a specific exposure issue. Health consultations are therefore more limited than a public health assessment, which reviews the exposure potential of each pathway and chemical [compare with public health assessment].

Health education
Programs designed with a community to help it know about health risks and how to reduce these risks.

Health investigation
The collection and evaluation of information about the health of community residents. This information is used to describe or count the occurrence of a disease, symptom, or clinical measure and to evaluate the possible association between the occurrence and exposure to hazardous substances.

Health promotion
The process of enabling people to increase control over, and to improve, their health.

Health statistics review
The analysis of existing health information (i.e., from death certificates, birth defects registries, and cancer registries) to determine if there is excess disease in a specific population, geographic area, and time period. A health statistics review is a descriptive epidemiologic study.

Indeterminate public health hazard
The category used in ATSDR's public health assessment documents when a professional judgment about the level of health hazard cannot be made because information critical to such a decision is lacking.

Incidence
The number of new cases of disease in a defined population over a specific time period [contrast with prevalence].

Ingestion
The act of swallowing something through eating, drinking, or mouthing objects. A hazardous substance can enter the body this way [see route of exposure].

Inhalation
The act of breathing. A hazardous substance can enter the body this way [see route of exposure].

Intermediate duration exposure
Contact with a substance that occurs for more than 14 days and less than a year [compare with acute exposure and chronic exposure].

In vitro
In an artificial environment outside a living organism or body. For example, some toxicity testing is done on cell cultures or slices of tissue grown in the laboratory, rather than on a living animal [compare with in vivo].

In vivo
Within a living organism or body. For example, some toxicity testing is done on whole animals, such as rats or mice [compare with in vitro].

Lowest-observed-adverse-effect level (LOAEL)
The lowest tested dose of a substance that has been reported to cause harmful (adverse) health effects in people or animals.

Medical monitoring
A set of medical tests and physical exams specifically designed to evaluate whether an individual's exposure could negatively affect that person's health.

Metabolism
The conversion or breakdown of a substance from one form to another by a living organism.

Metabolite
Any product of metabolism.

mg/kg
Milligram per kilogram.

mg/cm^2
Milligram per square centimeter (of a surface).

mg/m^3
Milligram per cubic meter; a measure of the concentration of a chemical in a known volume (a cubic meter) of air, soil, or water.

Migration
Moving from one location to another.

Minimal risk level (MRL)
An ATSDR estimate of daily human exposure to a hazardous substance at or below which that substance is unlikely to pose a measurable risk of harmful (adverse), noncancerous effects. MRLs are calculated for a route of exposure (inhalation or oral) over a specified time period (acute, intermediate, or chronic). MRLs should not be used as predictors of harmful (adverse) health effects [see reference dose].

Morbidity
State of being ill or diseased. Morbidity is the occurrence of a disease or condition that alters health and quality of life.

Mortality
Death. Usually the cause (a specific disease, a condition, or an injury) is stated.

Mutagen
A substance that causes mutations (genetic damage).

Mutation
A change (damage) to the DNA, genes, or chromosomes of living organisms.

National Priorities List for Uncontrolled Hazardous Waste Sites (National Priorities List or NPL)
EPA's list of the most serious uncontrolled or abandoned hazardous waste sites in the United States. The NPL is updated on a regular basis.

National Toxicology Program (NTP)
Part of the Department of Health and Human Services. NTP develops and carries out tests to predict whether a chemical will cause harm to humans.

No apparent public health hazard
A category used in ATSDR's public health assessments for sites where human exposure to contaminated media might be occurring, might have occurred in the past, or might occur in the future, but where the exposure is not expected to cause any harmful health effects.

No-observed-adverse-effect level (NOAEL)
The highest tested dose of a substance that has been reported to have no harmful (adverse) health effects on people or animals.

No public health hazard
A category used in ATSDR's public health assessment documents for sites where people have never and will never come into contact with harmful amounts of site-related substances.

NPL [see National Priorities List for Uncontrolled Hazardous Waste Sites]

Physiologically based pharmacokinetic model (PBPK model)
A computer model that describes what happens to a chemical in the body. This model describes how the chemical gets into the body, where it goes in the body, how it is changed by the body, and how it leaves the body.

Pica
A craving to eat nonfood items, such as dirt, paint chips, and clay. Some children exhibit pica-related behavior.

Plume
A volume of a substance that moves from its source to places farther away from the source. Plumes can be described by the volume of air or water they occupy and the direction they move. For example, a plume can be a column of smoke from a chimney or a substance moving with groundwater.

Point of exposure
The place where someone can come into contact with a substance present in the environment [see exposure pathway].

Population
A group or number of people living within a specified area or sharing similar characteristics (such as occupation or age).

Potentially responsible party (PRP)
A company, government, or person legally responsible for cleaning up the pollution at a hazardous waste site under Superfund. There may be more than one PRP for a particular site.

ppb
Parts per billion.

ppm
Parts per million.

Prevalence
The number of existing disease cases in a defined population during a specific time period [contrast with incidence].

Prevalence survey
The measure of the current level of disease(s) or symptoms and exposures through a questionnaire that collects self-reported information from a defined population.

Prevention
Actions that reduce exposure or other risks, keep people from getting sick, or keep disease from getting worse.

Public availability session
An informal, drop-by meeting at which community members can meet one-on-one with ATSDR staff members to discuss health and site-related concerns.

Public comment period
An opportunity for the public to comment on agency findings or proposed activities contained in draft reports or documents. The public comment period is a limited time period during which comments will be accepted.

Public health action
A list of steps to protect public health.

Public health advisory
A statement made by ATSDR to EPA or a state regulatory agency that a release of hazardous substances poses an immediate threat to human health. The advisory includes recommended measures to reduce exposure and reduce the threat to human health.

Public health assessment (PHA)
An ATSDR document that examines hazardous substances, health outcomes, and community concerns at a hazardous waste site to determine whether people could be harmed from coming into contact with those substances. The PHA also lists actions that need to be taken to protect public health [compare with health consultation].

Public health hazard
A category used in ATSDR's public health assessments for sites that pose a public health hazard because of long-term exposures (greater than 1 year) to sufficiently high levels of hazardous substances or radionuclides that could result in harmful health effects.

Public health hazard categories
Public health hazard categories are statements about whether people could be harmed by conditions present at the site in the past, present, or future. One or more hazard categories might be appropriate for each site. The five public health hazard categories are no public health hazard, no apparent public health hazard, indeterminate public health hazard, public health hazard, and urgent public health hazard.

Public health statement
The first chapter of an ATSDR toxicological profile. The public health statement is a summary written in words that are easy to understand. The public health statement explains how people might be exposed to a specific substance and describes the known health effects of that substance.

Public health surveillance
The ongoing, systematic collection, analysis, and interpretation of health data. This activity also involves timely dissemination of the data and use for public health programs.

Public meeting
A public forum with community members for communication about a site.

Radioisotope
An unstable or radioactive isotope (form) of an element that can change into another element by giving off radiation.

Radionuclide
Any radioactive isotope (form) of any element.

RCRA [see Resource Conservation and Recovery Act (1976, 1984)]

Receptor population
People who could come into contact with hazardous substances [see exposure pathway].

Reference dose (RfD)
An EPA estimate, with uncertainty or safety factors built in, of the daily lifetime dose of a substance that is unlikely to cause harm in humans.

Registry
A systematic collection of information on persons exposed to a specific substance or having specific diseases [see exposure registry and disease registry].

Remedial investigation
The CERCLA process of determining the type and extent of hazardous material contamination at a site.

Resource Conservation and Recovery Act (1976, 1984) (RCRA)
This Act regulates management and disposal of hazardous wastes currently generated, treated, stored, disposed of, or distributed.

RFA
RCRA Facility Assessment. An assessment required by RCRA to identify potential and actual releases of hazardous chemicals.

RfD [see reference dose]

Risk
The probability that something will cause injury or harm.

Risk reduction
Actions that can decrease the likelihood that individuals, groups, or communities will experience disease or other health conditions.

Risk communication
The exchange of information to increase understanding of health risks.

Route of exposure
The way people come into contact with a hazardous substance. Three routes of exposure are breathing [inhalation], eating or drinking [ingestion], or contact with the skin [dermal contact].

Safety factor [see uncertainty factor]

SARA [see Superfund Amendments and Reauthorization Act]

Sample
A portion or piece of a whole. A selected subset of a population or subset of whatever is being studied. For example, in a study of people the sample is a number of people chosen from a larger population [see population]. An environmental sample (for example, a small amount of soil or water) might be collected to measure contamination in the environment at a specific location.

Sample size
The number of units chosen from a population or an environment.

Solvent
A liquid capable of dissolving or dispersing another substance (for example, acetone or mineral spirits).

Source of contamination
The place where a hazardous substance comes from, such as a landfill, waste pond, incinerator, storage tank, or drum. A source of contamination is the first part of an exposure pathway.

Special populations
People who might be more sensitive or susceptible to exposure to hazardous substances because of factors such as age, occupation, sex, or behaviors (for example, cigarette smoking). Children, pregnant women, and older people are often considered special populations.

Stakeholder
A person, group, or community who has an interest in activities at a hazardous waste site.

Statistics
A branch of mathematics that deals with collecting, reviewing, summarizing, and interpreting data or information. Statistics are used to determine whether differences between study groups are meaningful.

Substance
A chemical.

Substance-specific applied research
A program of research designed to fill important data needs for specific hazardous substances identified in ATSDR's toxicological profiles. Filling these data needs would allow more accurate assessment of human risks from specific substances contaminating the environment. This research might include human studies or laboratory experiments to determine health effects resulting from exposure to a given hazardous substance.

Superfund [see Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and Superfund Amendments and Reauthorization Act (SARA)

Superfund Amendments and Reauthorization Act (SARA)
In 1986, SARA amended the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and expanded the health-related responsibilities of ATSDR. CERCLA and SARA direct ATSDR to look into the health effects from substance exposures at hazardous waste sites and to perform activities including health education, health studies, surveillance, health consultations, and toxicological profiles.

Surface water
Water on the surface of the earth, such as in lakes, rivers, streams, ponds, and springs [compare with groundwater].

Surveillance [see public health surveillance]

Survey
A systematic collection of information or data. A survey can be conducted to collect information from a group of people or from the environment. Surveys of a group of people can be conducted by telephone, by mail, or in person. Some surveys are done by interviewing a group of people [see prevalence survey].

Synergistic effect
A biologic response to multiple substances where one substance worsens the effect of another substance. The combined effect of the substances acting together is greater than the sum of the effects of the substances acting by themselves [see additive effect and antagonistic effect].

Teratogen
A substance that causes defects in development between conception and birth. A teratogen is a substance that causes a structural or functional birth defect.

Toxic agent
Chemical or physical (for example, radiation, heat, cold, microwaves) agents that, under certain circumstances of exposure, can cause harmful effects to living organisms.

Toxicological profile
An ATSDR document that examines, summarizes, and interprets information about a hazardous substance to determine harmful levels of exposure and associated health effects. A toxicological profile also identifies significant gaps in knowledge on the substance and describes areas where further research is needed.

Toxicology
The study of the harmful effects of substances on humans or animals.

Tumor
An abnormal mass of tissue that results from excessive cell division that is uncontrolled and progressive. Tumors perform no useful body function. Tumors can be either benign (not cancer) or malignant (cancer).

Uncertainty factor
Mathematical adjustments for reasons of safety when knowledge is incomplete. For example, factors used in the calculation of doses that are not harmful (adverse) to people. These factors are applied to the lowest-observed-adverse-effect-level (LOAEL) or the no-observed-adverse-effect-level (NOAEL) to derive a minimal risk level (MRL). Uncertainty factors are used to account for variations in people's sensitivity, for differences between animals and humans, and for differences between a LOAEL and a NOAEL. Scientists use uncertainty factors when they have some, but not all, the information from animal or human studies to decide whether an exposure will cause harm to people [also sometimes called a safety factor].

Urgent public health hazard
A category used in ATSDR's public health assessments for sites where short-term exposures (less than 1 year) to hazardous substances or conditions could result in harmful health effects that require rapid intervention.

Volatile organic compounds (VOCs)
Organic compounds that evaporate readily into the air. VOCs include substances such as benzene, toluene, methylene chloride, and methyl chloroform.

Other glossaries and dictionaries:
Environmental Protection Agency (http://www.epa.gov/OCEPAterms/)

National Center for Environmental Health (CDC)
(http://www.cdc.gov/nceh/dls/report/glossary.htm)

National Library of Medicine (NIH)
(http://www.nlm.nih.gov/medlineplus/mplusdictionary.html)

For more information on the work of ATSDR, please contact:

Office of Policy and External Affairs
Agency for Toxic Substances and Disease Registry
1600 Clifton Road, N.E. (MS E-60)
Atlanta, GA 30333
Telephone: (404) 498-0080

U.S. DEPARTMENT OF COMMERCE
Technology Administration
National Technical Information Service
Springfield, VA 22161 (703) 605-6000